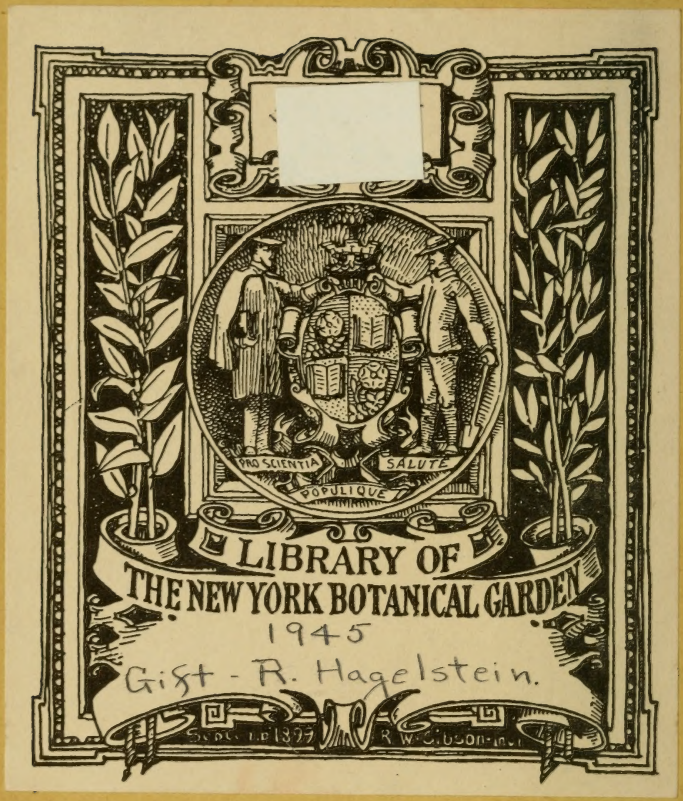

PRO SCIENTIA
SALUTE
POPULIQUE
LIBRARY OF
THE NEW YORK BOTANICAL GARDEN
1945
Gift - R. Hagelstein.

THE MICROSCOPE.

AN ILLUSTRATED MONTHLY DESIGNED TO POPULARIZE THE SUBJECT OF MICROSCOPY.

Edited by

CHAS, W. SMILEY, A. M.

VOL. II, NEW SERIES. (NOS. 13–24.)

1894.

LIBRARY
NEW YORK
BOTANICAL
GARDEN

Published by the Microscopical Publishing Co.
Washington, D. C.

·I4165
n.s.
v.2

LIB
NEW
BOTA
GAR

THE MICROSCOPE.

JANUARY, 1894.

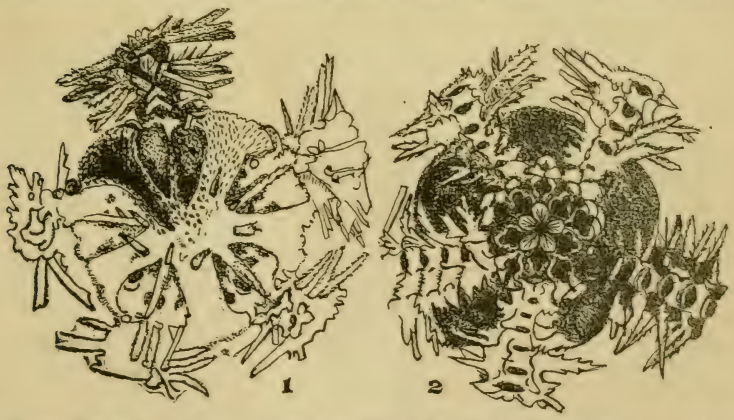
NUMBER 13. NEW SERIES.

Objects Seen under the Microscope.

VII.—DISC OF OPHIOCOMA.

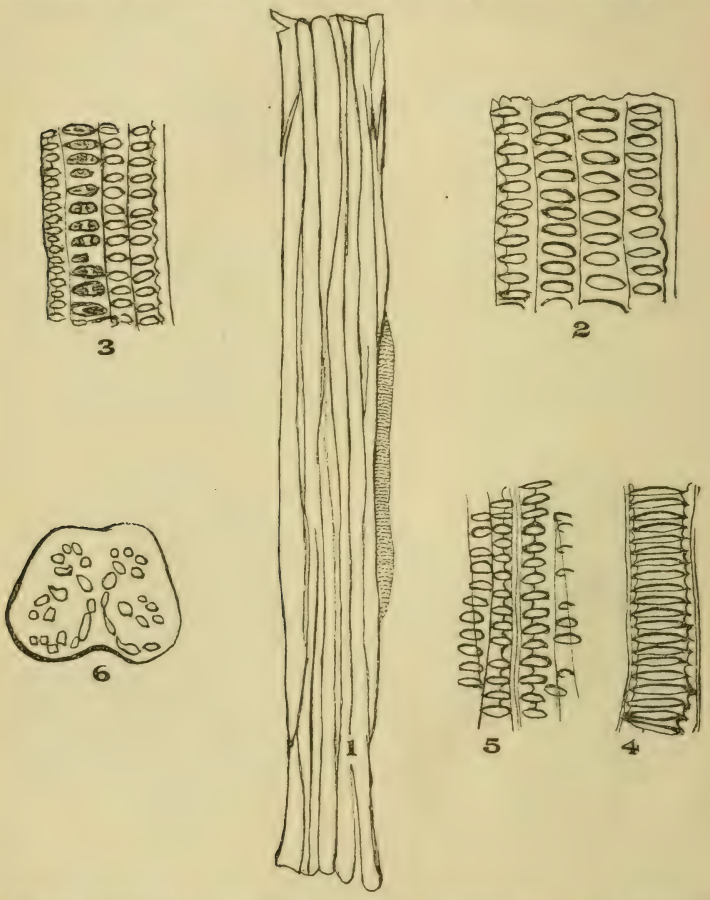
[PEN DRAWING.]

Ophiocoma is a star-fish of the variety often called brittle star or sand star. The discs are calcareous (limy) plates or skeletons, the spines of which make beautiful microscopic objects. Figure 1 is a view from above (dorsal) and Fig. 2 is a view from beneath (ventral), showing mouth aperture, teeth and their plates. These star-



fishes differ in size, some being as small as the dot on the letter i, and some measuring several inches with discs nearly an inch across. The "teeth" are to be seen in the center of Fig. 2 and look like the 5 sepals of a flower. These teeth like all teeth of Echini are pronounced as of the most wonderfully elaborate architecture to be found

in the Animal Kingdom. They show a gradual transition from the ordinary reticulated structure of the shell to the peculiar substance of which teeth in higher animals is made. The tooth is sometimes dissected out and mounted in balsam but it needs to be ground down some-



what to permit the light to pass through it. It is then seen that the base of the tooth is made of material like the shell and the upper or older part is made of bone, the intermediary part showing a gradual transition from shell to bone.

The disc of Ophiocoma can be bleached readily by immersion in caustic potash, but care must be taken not to go so far as to dissolve the integuments.

VIII.—SCALARIFORM DUCTS.

The stem of a fern is often of a deep brown color, very strong and hard. It owes these properties to a series of cells having very hard tissue called sclerenchyme. Within are series of bundles of Scalariform ducts (tracheides). They are so called from their presenting a regular ladder-like appearance (*scala*, a ladder). A thin section cut obliquely across the stem displays very well the beautiful structure of these ducts.

In the illustration (taken from the International Jour. Microscopy), Fig. 1 shows a bundle of Scalariform ducts taken from the British "bracken" (*Pteris aquilina*). It is enlarged 20 diameters. Fig. 2 shows a large duct enlarged 250 dia. and shows numerous elongated pores. Fig. 3 shows a duct with shorter pores. In Fig. 4 you can see the ladder well defined (250 dia). Fig. 5 is designed especially to show the thickness of the walls, and the projection of the so-called bars (250 dia). Fig. 6 is an end view of the bundle shown in Fig. 1. The ducts being cut across are seen to be firmly embedded in pleurenchymatous tissue.

Those wishing objects to use with their microscopes illustrative of Scalariform vessels, can send for Nos., 27, 28, 29 or 30 of White's objects. The four can be had for 30 cents in stamps.

The Typhus Bacillus.—Dr Fraenckel of Berlin, announces that he has discovered a typhus bacillus; and that by using it in vaccination, he has produced a rapid, benign course of the fever. Dr. Rumpf has cultivated an anti-fever bacillus which, he says, will cure typhus in eight days.

Microtome Knives and Their Care.

By BAUSCH & LOMB,

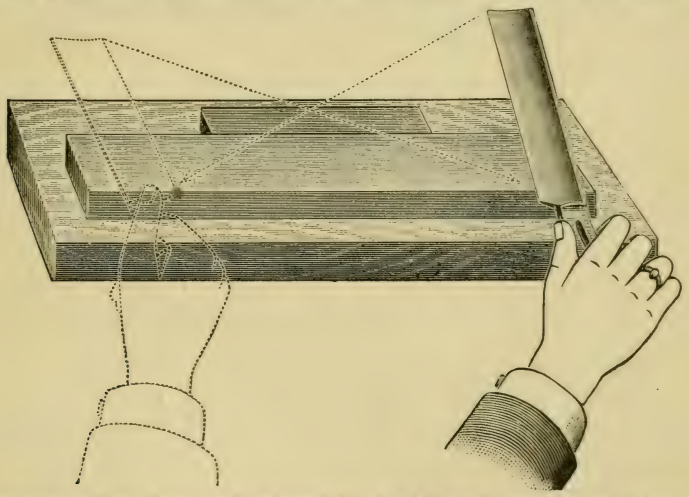
ROCHESTER, N. Y.

The requisites for good work in microtomy are, aside from the manipulative skill and the preparation of the specimen, a perfect working microtome and a good knife. The latter particularly, for, if the cutting edge is not in the best of condition, no good sections can be secured; we have had so many complaints from this source and for the reason that so few know the real *modus operandi* to obtain a keen cutting edge, that we present these instructions how to proceed to sharpen a knife and keep it in good condition.

We recommend to commence with, the yellow Belgian hone for the reason that it is the best obtainable; in using it, cover with palm oil soap and moisten freely with clean water so that a lather will be formed which must be kept during the entire time the knife is being sharpened. This soap has the advantage over the ordinary oils in use for honing in that the pores of the stone remain open, whereby quicker sharpening as well as a better edge and easier cleaning of the knife are the result. If a microtome knife is very dull or perhaps has small nicks in it, it is very essential to first sharpen it on a yellow stone and then draw it several times over a blue stone in order to obtain an exceedingly keen edge; with the blue stone is used a softer stone called "rubber" which is necessary, for, after the blue stone has been moistened with water, it is used to grind down the scum.

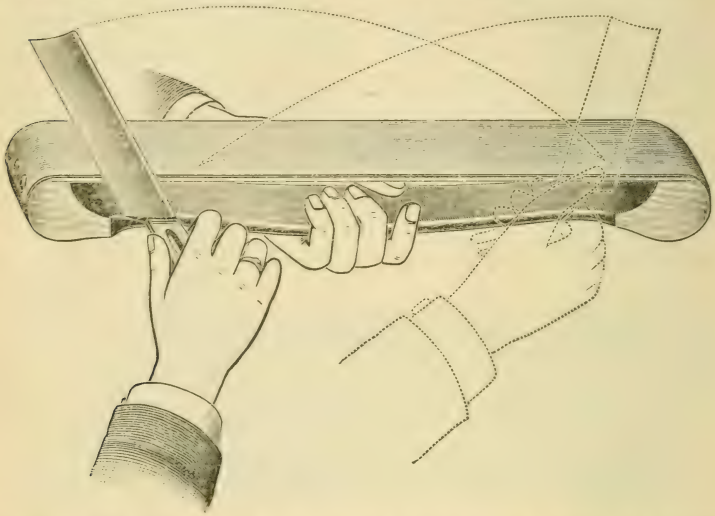
To begin with, the knife is sharpened on the concave side until a fine thread is formed on the cutting edge, which can easily be seen by drawing the knife across the finger nail; when this thread becomes visible along the entire cutting edge, the knife is passed without any pressure over the already prepared stone but in such a man-

ner that the entire edge is always toward the front as shown in Fig. 1. It is necessary that the mentioned thread be formed on the concave side only, in order that the amount ground off on the flat side be as little as possible. Should the ground surface on the lower flat side be too large, it will no longer be possible to obtain a perfect cut and the knife must be first of all reground on the flat surface. As soon as the thread appears, the knife is drawn equally to the right and left in the indicated directions, see Figure No. 1, without exerting the least pressure of the hand on the stone. After a uniform



keenness has been obtained by light and continued sharpening its quality can be judged by passing the edge of the knife lightly over the moistened tip of the thumb, and if the feeling that the knife will enter the skin be apparent, it shows that a sufficient keenness has been obtained on the stone and that its perfection can then be only attained by passing it over the strop. The knife is then carefully cleaned with an old linen cloth held between thumb and index finger, but in such a manner that this cloth does not touch the edge. After cleaning, it is lightly and carefully drawn across the strop with

the back of the knife towards the strop and without pressure of the hand, see Fig. No. 2. If the knife will now cut a hair freely along the entire edge it has attained the requisite keenness of a microtome knife, and after it has again been wiped off with a soft chamois skin it is



ready for cutting. It is to be suggested that the strop is slightly covered with oxide of iron, and rest on a flat and firm support. We recommend for this purpose a bow strop. Before each cutting of the preparations the knife should be passed over the strop.

Photographing Certain Natural Objects Without a Camera.

By PROF. W. A. KELLERMAN, Ph. D.
COLUMBUS, OHIO.

The objects referred to are those which are transparent or translucent, more particularly ordinary foliage leaves, and other botanical specimens, wings of certain insects, fins of fishes, etc. The process consists in using the object itself as the negative and printing from it in a photographer's printing frame, in the usual manner.

The majority of foliage leaves can be used, if it is desired to secure exact reproductions of their patterns of venation. Of many orders, such as Rosaceæ, Leguminosæ and Gramineæ, most of the leaves have veins sufficiently translucent to admit of their being used as negatives, without any preliminary preparation—even previous pressing and drying not being necessary.

But in case of many leaves of the orders Compositæ, Ericaceæ, Umbelliferæ, etc., they must be subjected to a process of bleaching in alcohol, followed by immersion in hot potassic hydrate; this is to be followed by thorough washing in pure and finally acidulated water, and pressing the leaves till dry between sheets of bibulous paper. Such prepared leaves will give pictures in which the veins and veinlets are dark and the remainder of the leaf light colored, just the reverse of the photographs obtained by using the fresh or dried leaves without further preparation. In either case the venation—even in minutiæ—will be well shown.

Sometimes young leaves, in other cases fully matured leaves, give the best results. Leaves from the herbarium can be used at will. If the veins or petiole are very much thicker than the remainder of the leaf, they can be shaved down. Other specimens may, in some cases, need trimming.

It is necessary that the object to be photographed be brought into *very close contact* with the sensitized paper, for, otherwise, all parts of the print will not be perfectly distinct. For this reason, the under side of the leaf—where, as a rule, the veins are more prominent—should be placed next to the clear glass in the printing frame, and the upper surface next to the sensitized paper. A layer of cotton or soft blotting paper can be placed over the back of the sensitized paper, which will insure closer contact with all parts of an object that may be somewhat uneven.

The time of exposure in bright sunlight will vary from a minute or two (for transparent wings), to fifteen or twenty minutes (for foliage leaves)—depending, of course, on the degree of transparency or translucency of the object. The print can be inspected from time to time and the proper density of the picture secured.

After exposure the prints can be fixed in a solution of hyposulphite of soda. Or if handsome photographs are desired, they can be toned in the gold solution commonly used by photographers, and fixed in the usual manner.

The process is so simple, so comparatively inexpensive, and the results obtainable so interesting that it is believed that the reward will be fully commensurate with the time and energy expended.

Moisture on the Cover Glass.—The cause of a deposit of moisture on the under side of the cover-glass must be sealing up before the object or the base on which it lies is thoroughly dry, or perhaps through the ring not being cemented properly on the glass slip, and so allowing the medium in which the finishing cement is dissolved to get through into the cavity in the cell in which the object lies, and condensing on the cover. The cure: With a sharp knife scrape off the ring of cement which lies on the surface of the cover-glass, also slightly down the side, about the thickness of the same; then warm the cover-glass slightly over a small spirit lamp, moving it about to prevent cracking it, and it should be then easily removable with the knife without injury either to the glass or object; then, before replacing, take care that the object is thoroughly dry. If the ring springs off instead of the cover-glass only, dry thoroughly; then put just sufficient cement on the underside of it to attach it to the glass, and let this dry thoroughly before finishing off.

Slides for Sale.—The Jersey Biological Station (England) will issue a quarterly publication and a series of 14 microscopical preparations of the rare and the less renown marine organisms. The text will describe the slides and give notes upon manipulation. The price is $5.25 for the year. Only 75 copies will be issued.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

The Microscopical Soiree.—One of our English Exchanges remarks: "It is gratifying to learn that the loss on the last soiree was only £10; for the Coroydon Club soirees are always excellent." Our own observation is that in America a few too-zealous individuals get up these entertainments at considerable expense, expecting others to pay a large part of the bills and somebody or society to be $50-75 out-of-pocket. What is the return? Suffocating crowds of people who do not know whether an amœba is an animal or a plant nor which end of the tube the object glass goes in, crowd around and ask "What is it?" say "oh! my, aint it lovely," and return home with no more knowledge than they carried there. Not once in a hundred does some one develope love enough for science to go and buy a microscope.

We are, therefore, in disfavor with the idea. We do not see why all this expense should be incurred. We have been told that there are microscopists so vain that they enjoy exhibiting themselves at these soirees and think that it pays. We do not like to believe it and at all events think the game is not worth the candle.

But what shall we do to create a public interest? In lieu of the soiree, hold a dozen meetings during the year to which members may bring friends selected for their appreciation of science, and young people who in school have shown some desire for

such knowledge as microscopy can impart. Let half of these meetings be exhibition evenings but let the explanations of what is to be seen, and how to utilize the facts be the prominent feature. Let the other half of the meetings be working sessions at which the visitors may see the processes of cutting, staining, mounting, etc., actually carried on and explained. Many a bright youth may have his thoughts bent in the right direction by this means, and the beauty of it is that the cost is zero and the plan productive of new members. The evil if any is that our conceited members cannot parade themselves before the dear public in the way that they are said to do at the soirees.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

181.—*What is a Catoptric Ocular?—S.*

This term probably means a reflecting microscope, or an instrument used for examining objects by reflected light.

182.—*Can you give me directions for Koch's "petrifying" method for sections of jaws and teeth?—J. D. Moody.*

Saw off a thin slice of the jaw and tooth, stain it, dehydrate in absolute alcohol, and imbed in a thickened chloroform solution of copal, on a glass slip. Evaporate the chloroform, then grind down the section on coarse and fine stones until it is thin enough, wash and mount in balsam.

183.—*What is Walmsley's arrangement whereby enlargements of objects can be made by anybody as mentioned in Stowell's Microscopical Diagnosis?—T. K. Butler.*

It is a small, dry-plate camera attachment which can be placed on the microscope tube and the object is then photographed.

184.—*I wish to begin the study of textile fibres. Where may I get information on the subject?—C. E. H.*

The literature is scattered through the Microscopical and Textile Journals. See A. M. M. J., Vol., VI, pages 22, and 47, for good descriptions of fibres.

185.—*How shall I stain muscle to show the Trichina well and how shall I mount it?—E. P.*

Any carmine stain will color muscle deeply and the Trichina lightly or not at all. The fresh material should be hardened in alcohol or otherwise, like any other pathological material; the sections cut, stained and mounted in balsam. Trichinous muscle shows well when mounted in Farrants' solution or in glycerine. Unstained, teased, trichinous muscle mounted in glycerine, makes a typical mount. Use well hardened material or the glycerine will macerate the trichinæ in time.

186.—*How shall I treat specimens of ham or pork to preserve them so sections can be cut by freezing, paraffin or celloidin process?—E. P.*

Soak the material in water to extract the salt, then harden in several grades of alcohol up to 95 per cent, and preserve in the latter grade until cut.

187.—*I have read that nerve tissue for microscopic study should not be placed in zinc chloride or in alcohol.—Why?—Medicine.*

Probably a mistaken notion that zinc chloride would injuriously affect the *corpora amylacea* sometimes observed in brain and cord specimens. These *corpora amylacea* are quite different from the real starch bodies found in vegetable tissue. Zinc chloride would not often be used on nerve tissue, but alcohol is indispensable. The so called *corpora amylacea* seems to be present in normal as well as pathological specimens and are probably of no importance.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Section Cutting.—It is almost trite to remark that first rate sections can be cut with a razor. While first class microtomes are a great luxury, a good sharp razor will answer all the purposes of study and investigation. Nearly all the great and important discoveries in tissues were made before the advent of microtomes. In cutting with a razor the amateur will do well to be content with very small sections. A very small piece of homogeneous tissue will exhibit all that a large section can.

Lichens.—These plants must be studied from sections. The sections cut with a razor can be made quickly, conveniently and satisfactorily. Shave a very small piece from the edge of any part of the thallus; place the section on a slide in any convenient fluid, put on a thin cover and view with a power equal to a quarter inch objective. To see the fructification complete, cut an apothecium in half and then shave a thin section along the cut surface, being careful to include the top portion. In this manner one will be able to see the hymenium with the asci and spores, the green conidia, the cortex and often the spermogones. Few specimens are more interesting and beautiful or will exhibit so many points at once. The specimens are easily obtainable and will well repay the student.

Puccinia.—Having a lot of leaves with many black, hard circular, raised spots scattered over them, I tried many ways of examining them but obtained no satisfaction. As a last resort, I had recourse to my razor, as above described. I cut the leaf through one of the black spots or sori and then made a very small thin section of the edge of one of the black spots. Placing this on the slide with a drop of potasium hydrate, covering with a thin circle and viewing with a one-fourth objective, a beautiful sight was unfolded.

Hundreds of obtusely accuminate pedicillate spores were disclosed with their arrangements upon the leaf. On mounting in balsam the spores assumed a golden yellow hue and formed a sight to gladden the eye of the microscopist. It proved to be *Puccinia malvacearum.*

Sclerenchyma.—This cell formation composes the hard tissues of nuts and of stone fruits. Excellent specimens may be obtained by cutting as above described.

The section should be taken from one of the halves of the nut, after removing with a knife, the smooth surface where the two halves join.

Cut a thin shaving about the size of a pin head and place upon a slide in any convenient liquid. The above parts are so hard that they will invariably nick the razor so that no razor of any value should be used in the experiment.

Dr. Moore's Method of Staining Blood.—The following is copied from Vol. III, page 136 of the American Microscop-

ical Journal and is a quick and efficient way of staining blood, and of double-staining nucleated blood.

The blood is evenly spread in a thin film on the slide, and dried in the usual manner. It is then covered with a solution containing eosin 5 grs, water 4 drachms, alcohol 4 drachms. In about three minutes this is washed off in a glass of water; and, without drying, a solution containing methyl green 5 grs., and one oz. of water is flowed over the slide. In about two minutes the slide is washed, dried and the corpuscle preserved in Canada balsam.

SCIENCE-GOSSIP.

Amœba.—This organism has been sectioned and stained in such various ways as to exhibit the organism of its minute structure far better than ever before understood. Amœba was believed to be very near to simple protoplasm, now it is found to contain an excretory system. One man has seen striations by means of which contraction takes place. Further research is going on in the Huxley Laboratory at South Kensington, London.

Scientific Work in Illinois.—Dr. Josua Lindahl has been dismissed from the post of State Geologist by political influence and an obscure collector of fossils put in his place. The late Prof. Worthen, while state geologist collected 2871 fine specimens which the state has purchased from his estate. In England, the making of private collections by a public official would be considered very improper and in our own country, the Smithsonian Institution emphatically prohibits every employee, even its messenger boys, from making private collections.

Mechanical Finger.—Occasionally one wishes to pick up a diatom or other small object in mounting, and the mechanical finger is about the only thing with which it can be done successfully. A slip of wood is held in place on the side of the tube by rubber bands. The end of this slip is split, and in the split is placed a cat's whisker. This is so pointed and stiff that it makes a good implement for the purpose. Arrange the whisker so that the point of it is in focus, and then spread your material on a slip. Pick out a diatom, and after moistening

the point of the whisker slightly, rack it down, and the diatom will adhere to it. Raise it up, and place the slip on which it is to be mounted on the stage. The surface of this must, of course, be prepared with a gum solution, such as is described in the text-books, and as the diatom touches it, it will leave the whisker and adhere to the slip. This is not offered as a substitute for the mechanical finger entirely, but it is a simple appliance that is easily made, and will be found useful many times by those who are not fortunate enough to possess something better for the purpose.—*Work.*

Stone Under the Microscope.—It is often held that the best method of determining the probable durability of a building stone is to study its surface, or thin transparent slices, under a microscope. This method of study in recent years has been most fruitful in developing interesting and valuable knowledge of a scientific and truly practical character. An examination of a section by means of the microscope will show not merely the various substances which compose it, but also the method according to which they are arranged, and by which they are attached to one another. For example, pyrites is considered to be the enemy of the quarryman and constructor, since it decomposes with ease and stains and discolors the rock. Pyrites in sharp, well-defined crystals sometimes decomposes with great difficulty. If a crystal or grain of pyrites is embedded in soft, porous, light-colored sandstones, its presence will certainly demonstrate itself by the black spot which will form about it in the porous stone, and will permanently disfigure and mar its beauty. If the same grain of pyrites is situated in or near very hard, compact, non-absorbent stone, the constituent minerals of which are not rifted or cracked, this grain of pyrites may decompose and the products be washed away, leaving the stone untarnished.

Higher Medical Education.—Rush Medical College will hereafter require four years attendance at college from students who begin the study of medicine. To encourage proper preliminary study, graduates in arts and sciences from most colleges, and graduates in pharmacy and dentistry from approved colleges will be graduated after an attendance on three courses of lectures.

The Newberry Fund.—Scientific work in geology, palæontology, botany and zoology is to be aided by the income from the $25,000 memorial fund to be raised to the memory of Dr. J. S. Newberry.

Bacteria Deprived of Sunlight.—The nitrifying bacilli of the soil are entirely removed from sunlight and seem to thrive on mineral food. How do they obtain energy with which to manufacture protoplasm from inorganic material? Doubtless from the gases or liquids within their reach. Prof. Johnstone Stoney, thinks (Sci. Proc. Roy., Dublin Soc., VIII, 154), that the energy may be imparted by the impact of the more swiftly moving molecules of these gasses and liquids. If that be the case, the excessive minuteness of the bacilli is explained.

CORRESPONDENCE.

White's Objects.—I would strongly urge those of your readers who desire beautiful, interesting and instructive objects for the microscope to send to Mr. C. W. Smiley for a few samples of White's botanical sections. They are well cut and stained and temporarily mounted, and can be examined in that way, but to see them at their best they must be mounted in glycerine or balsam. I have about twenty slides mounted in benzole balsam, and take great interest in them; that interest has increased since I have examined them by polarized light, and when a selenite plate is put under the object slide, they are beautiful beyond description, and must be seen to be appreciated. When the prisms in the polarizer are turned to show a dark ground illumination some of these sections show a differentiation of parts that are fine and clear. They stand out, as it were, with a solid, or stereoscopic appearance. So beautiful are they that I have placed them in the case where I keep my "Oh, my" slides.

I have not yet had time to make negatives of the beautiful objects mentioned above, but when I do, which will be soon, I will send several prints to be engraved. I have ordered from Carbutt a yellow ray filter, which used in connection with his orthochromatic plates, will give value to the staining.—Thos. J. Bray, Warren, Ohio.

THE MICROSCOPE.

Contents for January, 1894.

Objects Seen Under the Microscope VII.—Disc of Ophiocoma. (Illustrated) 1
VIII.—Scalariform Ducts 3
The Typhus Bacillus 3
Microtome Knives and Their Care, by Bausch & Lomb. (Illustrated) 4
Photographing Certain Natural Objects Without a Camera, by Prof. W. A. Kellerman, Ph. D. 6
Moisture on the Cover Glass 8
Slides for Sale 8
EDITORIAL.—The Microscopical Soiree 9
QUESTIONS ANSWERED.—Nos. 181-187, by Dr. S. G. Shanks 10
181. Catoptric Ocular 10
182. Koch's Petrifying Method 10
183. Walmsley's Arrangement 10
184. The Study of Textile Fibres 10
185. To Stain Muscle 11
186. Specimens of Ham or Pork 11
187. The Nerve Tissue for Microscopic Study 11
PRACTICAL SUGGESTIONS.—by L. A. Willson 11
Section Cutting 11
Lichens 12
Puccinia 12
Sclerencyhma 12
Dr Moore's Method of Staining Blood 12
SCIENCE GOSSIP.—Amœba 13
Scientific Work in Illinois 13
Mechanical Finger 13
Stone Under the Microscope 14
Higher Medical Education 14
The Newberry Fund 15
Bacteria Deprived of Sunlight 15
CORRESPONDENCE.—White's Objects 15

TO THOSE WHO HAVE REMITTED FOR 1894.

We feel especially and unusually thankful to those who have sent in their checks during the past five weeks.

Like others, we are struggling with the "hard times" and your promptness helps materially. We cannot write personally to thank each one, but we take this means of telling you how sincerely we appreciate your thoughtfulness. In spite of the times, which we believe will change before mid-summer, we shall be able to increase the number of our illustrations during the year.

SUBSCRIPTION PRICES.

The Microscopical Journal..... $2.00
The Microscope..... $1.00 } **Price for Both..... $ 2.50**

THE MICROSCOPE.

FEBRUARY, 1894.

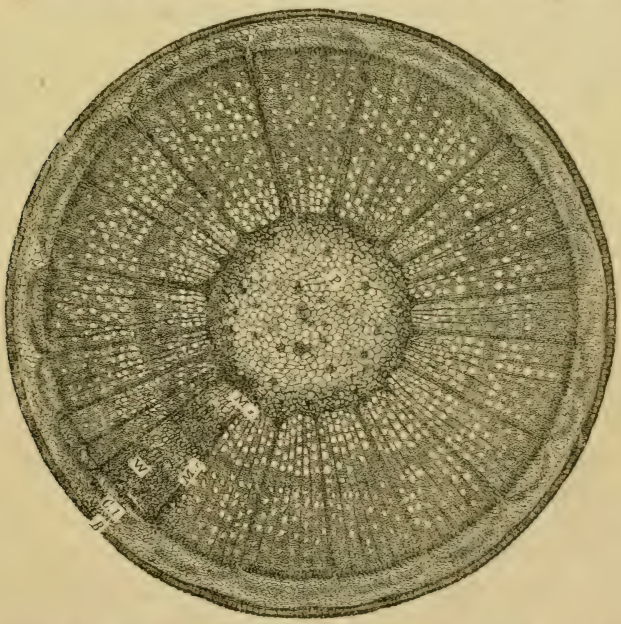
NUMBER 14. NEW SERIES.

Objects Seen under the Microscope.

IX.—SECTION OF STEM OF BEACH.

[PEN DRAWING.]

We have a lot of slides of wood sections which are being sent out as premiums and the illustrations herewith presented show their appearance under a magnification



of about 40 diameters. The descriptions which follow are intended to make plain to every body the meaning of what is seen in the slides.

The stem of a plant when seen under the microscope generally consists of three parts—pith, wood, and bark. The pith is in the center (P), the bark outside (B), and the wood (W), between the pith and the bark. This wood is separated into segments in the exogenous plants, so-called because growing from the outside, by medullary rays (M. r.) resembling the spokes of a wheel. They are composed of unchanged cellular tissue that extends from the pith to the bark. The pith (P), is composed of cellular tissue, and the cells are generally hexagonal in shape when seen transversly as in the cut. Sometimes they present a ragged appearance from being torn by the rapid growth of the plant and in the Monocotyledons the cellular mass in which are the fibro-vascular bundles corresponds to the pith and medullary rays together. Sometimes in the case of hollow stems the cells composing the pith have cracked and dried away or are attached to the sides in ragged patches. Immediately surrounding the pith is the medullary sheath (M. s.) composed of a delicate membrane, usually spiral in structure; this forms the limit of the woody portion of the stem. The woody portion extends from the medullary sheath to the cambium layer (C.l.). The latter is situated between the wood and the bark. The cambium is made up of a single ring of delicate cells which changes into cellular and vascular tissue thus forming new lateral cells and occasionally a new radial cell. When continued, these form a new ring of wood and also a new layer of bark. At the same time they piece out and extend the medullary rays as fast as the stem expands.

X.—SECTION OF STEM OF IRONWOOD.

The pith (P), medullary sheath (M. s.), medullary rays (M. r.), Wood (W), Cambium layer (C. l.) and bark (B) are all seen in the Ironwood as they were in the beach, but with marked differences. The pith is now less con-

spicuous, the medullary rays are much finer and greater in number consisting of more lines, the wood instead of being in two rings, is in nine rings, the cambium layer is narrower and the bark is much the same.

The bark is in three layers, the external (epiphlœum) which includes the corky layer, the middle or cellular envelope, and the liber. Next to the liber is the cambium layer which always separates it from the wood and it is in this that growth takes place. The epiphlœum

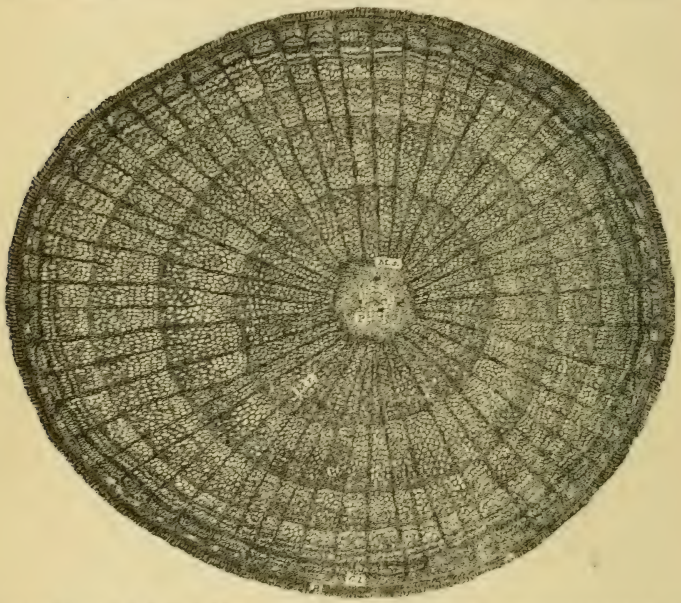
usually consists of two or more cubical or tabular layers and it is this which usually forms cork. Cork is by no means confined to one tree but exists in greater or less abundance in the bark of all exogenous stems. The middle layer is composed of cells and is more open than the preceeding layer and often forms canals which have the character of lactiferous vessels. This layer often forms the greater part of the bark. The liber consists of cellular vessels usually equaling in number the cells of the

wood, the one nearest the wood being the last formed. It also contains woody fibre and lactiferous vessels.

In the beech, where the bark is smooth, the growth takes place in the liber layers chiefly, the cellular envelope and cork merely expands to make room for the enlargement of the stem. The cork is composed of flat tabular cells, not of coarse cork tissue.

XI.—SECTION OF STEM OF SYCAMORE.

Here again can be seen the six parts of a stem as



pointed out above but with variations peculiar to this tree. The four rings of woody fibre are now very prominent, and the medullary rays to the number of over 50 stand out with great prominence.

The woody structure of plants is composed of woody fibres and ducts except in the Coniferæ where the latter are wanting. The woody structure of a stem of more than a year's growth has the appearance of being divided into concentric rings and each of these rings is supposed

to represent a year's growth, but some think that these rings represent only a period of growth and that a new ring is added each time a new set of leaves is formed. If in a season the tree's growth be stopped by drought and in the fall a new set of leaves be formed the stem would have two rings the width of both together being a little less than that usually produced in a single year. The width of the rings is usually greater near the pith and decreases towards the bark. Their composition (cellular and vascular tissue) is uniformly the same whatever their thickness but the arrangement varies. Sometimes the vessels predominate as in the Beech and Sycamore and sometimes the cellular tissue as in the Ironwood. Sometimes the vessels are uniformly distributed throughout the entire ring and sometimes they predominate toward the center. Sometimes they are distributed with regularity throughout the ring but the most general manner of distribution is that in which most of the vessels are near the inner surface of the ring which is the first part formed. The more vessels there are, the softer is the wood—Sycamore is softer than the two preceding woods. Ironwood is harder than the other two because it has the least number of vessels.

SPONGES.

By M. PFLAUM,

PITTSBURG, PA.

[Read before Iron City Microscopical Society, January 9th, 1894.]

What is a sponge? Perhaps most of us might be pardoned for defining it to be that soft porous toilet article so useful and convenient for many purposes. We see it and handle it every day, and the familiarity which in this case certainly breeds indifference, deprives us of a delight which the slightest study of the subject would give us.

In our collection of slides we have of course spicules of sponges, and this seems generally to satisfy us. It cannot be said that a sponge in its natural condition is an object of beauty or should in any way attract an amateur microscopist. We should therefore be thankful to those patient investigators who extract, by perseverant labors, interesting knowledge from nature, as bees gather honey from flowers. To taste these sweets I have consulted Kent, Carpenter and the Cyclop. Brit.

Classification.—The exact classification of sponges has not yet been definitely agreed upon. Prof. Haeckel insists to place them with the Cœlenterata, and as a close relative of the Corals, mainly because he claims for them an ectoderm and endoderm and a true process of sexual generation by germ cells becoming fertilized by sperm cells, which latter claim is affirmed by Carpenter. Kent, however, very forcibly denies both of these claims, finds neither ectoderm nor endoderm, nor any indication of sexual generation; and therefore allies sponges with the Choano-Flagellates or funnel-shaped flagellate infusorias as classified by him. Sponges are generally divided into four classes according to the nature of their skeletons or spicules. 1. Calcareous sponges having spicules of carbonate of lime. 2. Silicious sponges, which exist in the greatest number, having silicious spicules. 3. Keratose or horny sponges, being the sponges of commerce. 4. Gelatinous sponges in which all spicules are absent. All sponges, however, no matter what their skeleton, are composed of a soft slimy sarcode forming the body, covering the exterior as well as the base of the interior canals, ducts and cavities and forming a connective tissue, showing, however, no fibres.

Structure.—All sponges from the most simple to the most complex have the same special characteristics to a greater extent perhaps than any other class of beings. Just as each species can be clearly defined from the

other so all have well-defined qualities which unmistakably mark them as a separate branch of creation. These characteristics may be stated as follows: 1, on the exterior of the body are many, more or less minute, openings—pores for admitting water into the interior, and one or more larger openings—oscula—for emitting water from the interior without any other exterior organs; 2, the animalcule or colony of animalcules is concealed in the interior without any contact with the exterior; 3, the animalcule has a collar and flagellum.

Pores.—These exist in innumerable quantities, and can generally be contracted. What causes the influx of water has not been sufficiently ascertained. Some species have been observed with ciliary motion at the pores, but this has not been proved sufficiently. It may be possible that the natural pressure of the water surrounding the sponge may cause it, without any artificial effort to enter the body no matter how small or narrow the pores. No matter how, the fact is water does enter, and this fact upon the slightest consideration becomes one of great interest and another proof of nature's marvelous adaptability of means to ends. Of course the use of the water is clearly apparent and is the same as for all infusorian food. However, *how* this water is used is an interesting question. It passes through the internal canal system, the food particles it contains are taken up and the remainder, together with the fœcal matter, is sent into larger canals out through the external larger orifices called, wrongly, oscula. As these oscula might with their polluted contents taint the inflowing water, they are arranged according to the growth of the sponge: where upward these oscula stand elevated above the pores; where downward, as hanging on rocks, even with pores, as in such case the matter sent out naturally will leave the sponge.

In a live active sponge the inflow through the minute

pores can hardly be noticed except by using colored particles which have been observed to enter the sponge. In one case indigo being used gave the whole sponge a bluish tint. But the outflow has been likened by observers to a continual fountain. A little sponge placed in a saucer of water sent out a stream twelve feet long. This was in open air, offering comparatively no resistance. It must be apparent that an enormous force must be required to send out a stream against the necessary resistance and pressure of the surrounding water. Again, is this inflow and outflow continuous, especially the inflow, which may be caused by external pressure alone? Observations have shown the negative. It was found that the opening of both the pores and osculae are within the control of the sponge and can be opened and closed at its pleasure. Here the wonder increases: how, without any apparent force—controlling organ—power is exerted. The seat of power in sponges is supposed to be in the amœboid bodies, mentioned hereafter. But even were this confirmed, it would be open to further investigation how these bodies can exercise force upon another part of the sponge separated from, and without any noticeable connection with them.

Canals.—If there are two currents of water, there must necessarily be two different water ways, each serving its own purpose. The incoming currents are of course small, their contents after being utilized enter a larger opening acting as a cloaca, and thereby leaving the body. The simplest form (*Ascetta primordialis*) has but one osculum, being the mouth of a large central cavity, into which the smaller influent canals enter. In the higher orders the canal system is very diverse, intricate and numerous. The water entering the pores does not in all cases pass through simple ducts before reaching what may be called digesting chambers, but in the simpler forms enters at once into what Kent calls ampul-

laceous sacs ; Carpenter, flagellate chambers ; in which the sponge animalcule "lives, moves and has its being." These chambers according to Kent are the main characteristics and chief points in the classification of sponges. In shape these chambers differ in each species, some are circular, others oval or semi-circular or pointed at each end. These chambers are lined with the mucillaginous sarcode—cytoblastema, having imbedded in them, facing the center of the chamber, the sponge animalcule. In shape they are round or oval cells, as a body, having upon each a funnel-shaped hyaline collar of nearly the length and breadth of the cell, with a flagellum extending from the cell through and out of the collar. The discovery of this zooid was made comparatively recently, 1866, by a Pennsylvanian, Prof. H. James-Clark. These zooids, like all infusorias, show the presence of a nucleus and two contractile vesicles at the posterior end. Their functions seem to be of a respiratory nature, but chiefly to gather food. The flagellum, by rapid motion creates a current, which striking the outside of the collar, which also has a motion of a nature which caused Kent to call it circulatory or cyclosis, makes all food particles adhere thereto, from which they are drawn up over the rim and thence along the inner surface into the body of the animalcule. Before proceeding farther it should be remarked that each of these flagellate zooids is a separate being without any bond or connection with its neighbor, except being all attached to the same connective tissue, the sarcode, or cytoblastema. The process of feeding just related has been beautifully demonstrated by Kent, by mixing the food water with carmine. It is claimed that each zooid exudes excremental matter through its food channel, but this like many other facts remains yet to be verified. In this category of "claims" also belongs the location of the mouth at the root of the flagellum.

These zooids are amœboid in their nature. Both the collar and flagellum can be inverted and be received within the body of the animalcule. It can also send forth processes, pseudopods, with or without the indrawing of the collar and flagellum.

Internal Structure.—In Keratose—horny—sponges the skeleton is familiar to all. The substance is named "spongin." How Gelatinous sponges are held together, may be inferred from what we observe in jelly fishes. Calcareous and Silicious sponges, having possibly a more fluid sarcode, are provided with spicules generally so placed as to serve as a skeleton. These spicules are as beautiful in form as multitudinous in variety. In some species the spicules coalesce and cause thereby objects of wondrous beauty as Venus flower basket (*Euplectella*). In others spicules are attached to the outside for defensive purposes.

In addition to spicules, and generally lying close to them, sponges contain granular bodied irregular masses, which have been recognized as amœboid cells, and named cytoblasts. Neither spicules nor cytoblasts come in contact with the flagellate chamber. The exact functions of these amoeboid bodies are as yet in doubt. As before stated, it is believed that they exert whatever force a sponge exercises. But it is further surmised that they also take hold and remove all foreign substances which have entered the sponge. In higher organisms other cells and minute structures have been observed, the uses of which have been differently interpreted.

Life History.—Of this little is known, much surmised. Prof. W. J. Sollas of the University of Dublin, the author of the article on sponges in the Encyc. Brit. quotes authorities for the occurrence of both sexual elements in the same individual, but in uneven quantities; the male predominating in one, the female in others. One authority given by him found one male to 100 female forms.

In some sponges the sexes are claimed to be distinct. Both sperm as well as germ cells are claimed to develope from wandering amœboid cells which first exhibit lively amœboid movements, but later on pass into a resting stage. This, as already indicated, is strongly advocated by Prof. Haeckel. Kent, however, differs radically from this view, and knows only the following process: One or more sponge zooids, having lived its or their allotted span, become quiescent, take on an amœba form, become a cell in which spores are generated, which, when sufficiently advanced, pass out through the osculae. The cell looses its shape, and what are called "swarm-gemmules" appear. These, when sufficiently developed, show on their upper part flagellated collared cells with undeveloped cells beneath. Ultimately they settle on some firm substance and begin sponge life like their parent.

In the case of commercial sponges, artificial propagation of sponges, by cutting from live specimen, has been successfully attempted under the auspices of the Italian government. Pieces about an inch square were cut containing part of the exterior of the subject. These were tied to sticks and submerged in the proper locality. This process proved a success, but had to be abandoned by reason of serious objections from fisherman.

Slides for Sale.—The Jersey Biological Station (England) will issue a quarterly publication and a series of 14 microscopical preparations of the rare and the less renown marine organisms. The text will describe the slides and give notes upon manipulation. The price is $5.25 for the year. Only 75 copies will be issued.

To Write on Glass.—Make an ink by dissolving in a warm water bath; bleached shellac, 10 parts; venetian turpentine, 5 parts; oil of turpentine, 5 parts. When dissolved, add 5 parts of lampblack. Use with a pen the same as other inks.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

A Geological Survey could be made of practical benefit in business operations by giving advice upon the location of mines, the sinking of wells, and selections of sites for cemeteries, forts and heavy buildings, the obtaining of material for building roads, the nature of soil and subsoils with reference to drainage, etc.; but we are sorry to think that government surveys usually pay little attention to such things, but busy themselves with hunting fossils, in studying names and synonyms, in trying to ascertain the order of deposits in geological time and to find out how old the earth is; not to mention the junketing trips, the nepotism and favoritism, the expense, extravagance and concealed or obscure methods of inducing legislators to make appropriations and to suppress investigations. Would it not be better to depend upon the popular appreciation of practical results? Experience of capable men has shown that it would not be practicable to do so, and hence the prevailing methods.

Snails Live Indefinitely.—Only the other day a specimen from an island off the coast of lower California, inclosed in a drawer with part of the molluscan collection, was found to be alive. It had had no food or water for more than six years. When placed in a box with moist earth it protruded its foot and began to move about, and seemed to be as well as ever. Some time ago a few snails of a different species, gathered in

Mexico, reached the Smithsonian Institution and were placed in a box. They remained undisturbed for two years and three months, at the end of which time they were put into a jar of glass with some chickweed and a small quantity of tepid water. Pretty soon they waked up and appeared quite active.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

188. *What is the best way to reduce, clean and mount the Radiolaria from Manitoba?—C. S.*

Boil a piece of this shale with a crystal of sal-soda of equal bulk and a small quantity of water in a wide test-tube. When the shale begins to break down, flood it with hot water and pour it into another test-tube to deposit. Repeat the above boiling with soda and water on the remaining hard fragments of shale until enough disintegrated material has been obtained. The time of contact with the sal-soda should be as brief as possible, because the siliceous radiolaria will be corroded by any long contact with caustic alkalies. Collect the sediment into one tube, flood with clean water, allow the sediment to fall, pour away the water, add more, and so on, until the sediment is well washed and free from soda. Remove the water as nearly as possible, add about a half dram of strong nitric acid, boil, drop in a small crystal of potassium bichromate, boil thoroughly, add water and wash as above, until the acid is removed. Examine a drop of the sediment. If the forms are not clean, repeat the boiling with acid and bichromate and wash again as above. There is much fine sand and spicules present which may be removed to a certain degree, by shaking the sediment in a test-tube full of water and pouring away as soon as the heavier radiolaria have settled, and while the finer particles are still floating. This repeated several times, will clear the deposit enough to allow a fairly clean mount to be made. Place a drop of the sediment in the center of a concaved slip, or varnish ring cell, dry, add a drop of balsam, boil it gently over a lamp, apply a cover, and harden *without pressure.*

The forms are not numerous and are best picked out singly with a mechanical finger, if a really clean mount is desired.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

Photomicrography.—The microscope is placed in a horizontal position. The mirror is then vertical, and the tube with the eye-piece is inserted into the camera. Where the tube enters the camera a black cloth is carefully wrapped to exclude all light. Light from an acme lamp is directed upon the concave mirror and reflected from behind upon the object through the tube. A small piece of camphor is placed in the oil of the lamp. In this way, *Arachnodiscus* has been beautifully taken with a Spencer one-sixth immersion objective. With an inch objective, I photographed a Calyptra of a Moss and the Pollinia of Milk Weed and an Ovipositor of a Fly with such definition of every minute detail, that no retouching of the picture was necessary. With the one-sixth and exposure of fifteen minutes and with the inch, ten minutes was all that was required.

Examining Writing.—Great issues often depend upon the determination as to which of two signatures to a document were first written. The solution of this problem is more difficult than would at first be suspected. The appearance of the lines to a non-expert is frequently the opposite to the truth. Experience and intelligence are requisite to the interpretation of the picture unfolded by the microscope. Delicate focussing and observing which line first comes into view is one test. Try this test by both transmitted and reflected light. Another test is the "web." The web is formed by the ink of the last writing, running into the first. This is a very interesting subject to experiment upon. Try it with crossed thick lines and crossed thin lines, thin lines across thick lines and thick lines across thin lines, with the same and with different inks, with slow strokes and quick strokes, and one will be surprised at the intricacy of the problem.

Photography is a good adjunct to the microscope on matters of this kind. First take a negative, from that make a positive then photograph the positive where the lines cross. In the print

resulting from the last negative it may readily be seen which line is on top.

Fats.—Nearly all fats are beautifully crystalline. To study the crystals of different fats, I prefer a quarter inch objective. Place a very small portion of the fat on a slide and press out into a thin film with the thin cover. Dr. Thomas Taylor's method of examining butter with the polarizer is interesting. Boil the butter a few minutes set away in a pill box or other receptacle to cool. Fill a shallow cell with sweet oil. Put in a small portion of the boiled and crystalized product, gently scatter the granular crystals through the oil, place on thin cover, and view with polarized light. Do not treat them roughly while scattering as you would break up the crystals. I have treated lard in the same way and produced crystals of the same rotund form as butter crystals, but which exhibited a different cross from the pure butter crystals.

Stomata.—These organs of a leaf may be easily examined by scraping a small portion of the cuticle, spreading it upon a slide in a drop of any convenient fluid, covering and examining. They may be seen with a low power but will appear best under a quarter objective.

SCIENCE-GOSSIP.

Sectioning.—If you have never tried the "Bayberry Tallow" method of sectioning loose tissues like lung and pancreas, you have never succeeded in getting the most perfect mounts.

Look Sharp.—"From a single and hasty view of bodies under the microscope we are liable to form erroneous ideas of form."

RECENT PUBLICATIONS.

Funny Bone. A Book of Mirth for Doctors, Druggists, Dentists, Medical Students and Others. St. Louis, Mo., 1894. Price 50 cents.

This is a book of caricatures and jokes which have been compiled from the medical journals, etc. Some of them are very good. Over 150 of the illustrations are said to be original. Whoever enjoys such things can afford to send 50 cents to the Publishers, 1421 Market Street, St. Louis, Mo.

THE MICROSCOPE.

Contents for February, 1894.

Objects Seen Under the Microscope. IX.—Section of Stem of Beach 17
X.—Section of Stem of Ironwood 18
XI.—Section of Stem of Sycamore. (Illustrated) 20
Sponges, by M. Pflaum 21
Classification 22
Structure 22
Pores 23
Canals 24
Internal Structure 26
Life History 26
Slides for Sale 27
To Write on Glass 27
EDITORIAL.—A Geological Survey 28
Snails Live Indefinitely 28
QUESTIONS ANSWERED.—No. 188, by Dr. S. G. Shanks. 29
PRACTICAL SUGGESTIONS.—by L. A. Wilson 30
Photomicrography 30
Examining Writing. 30
Fats 31
Stomata 31
SCIENCE GOSSIP.—Sectioning 31
Look Sharp 31
RECENT PUBLICATIONS.—Funny Bone 31

THE MICROSCOPICAL JOURNAL.

Contents for February, 1894.

On the Study of Yeasts, with Descriptions of the Hansen Culture Box and of a New Infection Needle for the Study of Lower Cryptogames, by J. Christian Bay. (Illustrated) 33
Aeration of Tissues and Organs in Mikania and Other Phanerogams, by W. W. Rowlee. 45
Centering Device for Turn-Table, by E. E. Masterman. (Illustrated) 49
Radiolarian Shale from Manitoba, by Fred'k B. Carter 51
On the Development of the Continental Form of Microscope Stand, by J. B. Nias, M. D. (Illustrated) 53
Collecting and Studying Parasitic Insects, by Herbert Osborn. (Illustrated) 56
A Homogeneous Objective Condenser, by William Lighton 59
LETTERS TO THE EDITOR.—Rush Medical College 61
Tariff on Books 61
Spores in Syphilitic Blood 62
EDITORIAL.—The Microscope in School 62
A Chance to Use the Microscope to Save Cattle 62
MICROSCOPICAL APPARATUS.—A Big Microtone 62
Wax Models of Microscopic Objects 62
MICROSCOPICAL MANIPULATION.—Mayer's Carm-Alum 63
Hermann's Fluid 63
DIATOMS.—The Grandest Collection on Earth. 63
MICROSCOPICAL SOCIETIES.—The Sphinx Society, Atchison, Kans. 64

THE MICROSCOPE.

MARCH, 1894.

NUMBER 15. NEW SERIES.

Objects Seen Under the Microscope.

IX.—Various Forms of Bacteria Supposed to Cause Disease.

List of Illustrations.

1. Consumption. *Bacillus tuberculosis.* Diameter 1-100,000 inch.
2. Diphtheria. *Bacillus klebs-loffler.* Dia. 1-40,000 inch.
3. Pneumonia. *Micrococcus pneumonia.* Dia. 1-35,000 inch.

4. Leprosy. *Lepra bacillus.* Dia. 1-100,000 inch.
5. Pyæmia. Micrococcus from pus.
6. Typhoid fever. *Bacillus eberth-gaffky.* Dia. 1-40,000 inch.
7. Scarlet fever. *Streptococcus pyogenes.* Dia. 1-35,000 inch.
8. Cholera. *Spirillum choleræ.* Dia. 1-60,000 inch.

9. Anthrax. *Bacillus anthracis.* Thickness 1-25,000 inch.
10. Relapsing fever. *Spirochæte obermaieri.* Spirilla from the blood.
11. Influenza (La Grippe). Dia. 1-110,000 inch.
12. Pus. *Staphylococcus pyogenes aureus.* Dia. 1-35,000 inch.
13. Yeast fungus. Dia. 1-3,000 inch.
14. Glanders. *Bacillus mallei.* Dia. 1-60,000 inch.
15. Pneumonia. *Pneumococcus friedlander.* Capsulated micrococci.
16. Consumption. One tubercle containing spores.
17. Typhoid. Bacilli containing spores.
18. Anthrax (malignant pustule). Bacilli from blood.
19. Saliva. Various forms found in the mouth.
20. Asiatic cholera. Some joined in threads and some S shaped.

These disease germs shown in the 20 figures and enumerated in the accompanying list are so small as to test microscopical skill to the utmost. None but the highest powers and most costly objectives will reveal them and then only by means of stains and other aids. Some bacteriologists deny that the microscope alone can identify these different bacteria one from the other. Consequently they resort to what they call cultures in which they multiply indefinitely their numbers. The appearance and behavior of these colonies consisting of millions of single bacteria furnish a sure clue to their species. The effects produced in rabbits and other animals are also taken as proofs of their identity. As then the forms are so illusive even under the highest powers, they have not yet been fully described and classified morphologically, or in respect to the forms they present to the eye. While, therefore, the pictures we give are to some extent true, there are other bacteria not pictured here which, when pictured will not present a different appearance from some of these. In some cases of bacteria which look alike to the eye, one will stain easily with Aniline while another will not. For instance the Bacillus tuberculosis resists the stains which are effective with many species and requires special methods. Some bacteria will multiply when placed upon slices of raw potato, others will not. Some grow upon the surface of bouillon, others

not. By combining these various tests, bacteria may be identified when the microscope alone cannot do it. For understanding all these details, one needs a Manual of Bacteriology like that of Dr. Sternberg, or a little compend like that of Dr. M. V. Ball.

These minute organisms are present when the diseases named occur but some of them are sometimes present when the disease does not occur. Instead of saying that they cause the disease it is safer to say that when these germs find the system enfeebled or otherwise favorably disposed to harbor them disease is able to arise from the combined conditions, and it is quite certain that the several diseases could not occur provided the attendant germs were annihilated or kept out of the system.

These then are all communicable diseases and we should know in what manner the infection is transferred and so seek to avoid it. Happily we are able to say what the method of transmission is in many cases and to avoid it. For instance, we know that a consumptive has in his saliva millions of these germs, that if he spits upon floors, the ground, etc., the liquid soon dries up and the dried germs go floating in the air, to be breathed into the lungs of thousands of passers by. If the recipient is in sufficiently robust health no harm comes, but if the germ gets a start in the lungs it will multiply indefinitely and until death or cure ensues. Should every consumptive carefully preserve and burn all of his expectorations, the disease would soon be banished from the earth.

In 100 cases studied by one observer, it was found that 80 had been inoculated by occupying rooms which had previously been occupied by consumptives without proper methods of cleansing having been employed. Public drinking cups are another means of communicating infection.

The microscope has proved that we cannot live for ourselves alone. The interest of one is the interest of

all. He who goes through life casting his uncleanly product into halls, cars, shops, etc., himself will breathe in some other kind which some other careless person has thrown off in disregard of all human rights.

Typhoid and Cholera germs pass from the bowels of the sick with these diseases and in most cases of infection the germs have got into rivers, wells and drinking water. All this can be prevented if the discharges are disinfected with carbolic acid or burned.

Persons who die of diphtheria contain the germs and their bodies may taint the soil. In Normandy, such a body was exhumed after 23 years had elapsed. those who dug up the body and afterwards some other people were taken sick. A perfect epidemic of diphtheria resulted. This is why cremation is so strongly advocated by some people.

Milk from tuberculous cows is infected and there is no safety except in boiling the milk. The boiling point of heat kills the germs. If water is suspected it also should be boiled before using in food or as drink.

Health officers have found that there are at present five of these diseases which are very destructive when neglected but which yield readily to the means of control now known. These five are consumption, diphtheria, pneumonia, typhoid fever and scarlet fever. Dr. Gamber of the Michigan Board of Health has given the following synopsis of these five bacilli.

The bacillus of tuberculosis is the principal factor in the disease so commonly known as consumption, and is the cause of more deaths in the State of Michigan than any other single disease. Their shape is in the form of rods with rounded ends; average length, 1-10,000 of an inch; diameter, 1-100,000 of an inch. The bacilli are said to have an enduring form, and it has been demonstrated by experiment that it retains its vitality in desiccated sputum for several months. A susceptible individ-

ual may take this disease through an open wound, or an abrasion of the skin; but the respiratory tract furnishes the best medium for infection. A very common mode of infection, especially in children, is from the ingestion of milk from cows affected with tuberculosis. The temperature for the growth of this germ is 99° F., and they multiply slowly. The thermal death-point is 160° F.

The bacillus of diphtheria is the specific germ of that dreaded disease, diphtheria. They are rod shaped, straight or slightly curved, with rounded, club-shaped ends, having a length of 1-10,000 of an inch, and a diameter of 1-40,000 of an inch. Infection may take place from inhaling the poison, or where there is an abrasion of the skin; also from the food taken, and especially milk, which is a favorable medium for the growth of this bacillus. The development takes place at a temperature of from 70° to 107° F.; the most favorable temperature is 95° F. The thermal death-point is 140° F. The diphtheria germs have a great tenacity for life, may remain virulent for many months and tolerate the exposure to rain and sunshine during the months of April and May.

The micrococci of pneumonia are spherical or oval, usually united in pairs, or in chains consisting of three or four elements, which are srruounded by a transparent capsule. In length they are about 1-25,000 of an inch; diameter 1-35,000 of an inch. Infection from this micrococcus takes place through the medium of the respiratory passages. These germs are found in the saliva and nasal secretions in many persons in good health for days and weeks at a time,—perhaps they are waiting for the lungs to become irritated from a cold or from epidemic influenza so that it may cause its own specific disease, pneumonia. Blood heat, 98° F., is most favorable for their growth. The thermal death-point is 130° F.

The bacilli of typhoid fever have an average length of 1-12,000 of an inch, and a breadth of 1-40,000 of an inch,

with rounded ends. Their growth is most rapid at blood heat ; thermal death-point, 140° F. They are long lived and will endure most any kind of weather, and find their way into the system through the medium of drinking water, milk or other food.

The pathogenic micro-organism of scarlet fever has not as yet, been fully demonstrated, but some good German and French authorities found in all these cases examined, a streptococcus identical with the streptococcus of erysipelas. Sternberg says : "In the diptheritic exudate frequently seen in the angina of scarlet fever a streptococcus is commonly found which appears to be identical with streptococcus pyogenes." Baumgarten believes these germs to be varieties of the streptococcus pyogenes. So that at present there seems to be no good reason for doubting that this is the specific infectious agent in scarlet fever, and enters the system by the mouth and nasal passages.

The streptococcus pyogenes is the specific germ in our severe cases of blood poison, and cannot be identified from the streptococus of erysipelas, but bacteriologists observe that the effects produced by them are somewhat different, as proven by the inoculation of the lower animals with artificial cultures of these germs. They are spherical in form, with a mean diameter of 1-35,000 of an inch. They multiply freely at ordinary room temperature, 60° to 70° F., but more so at blood heat. Thermal death-point is 130° F. This is also called the chain-coccus, on account of the arrangement in more or less elongated chains. Its peculiarity is to extend rapidly along the lymph spaces and lympthatic vessels ; and if it commences about the hand it extends up the arm, and may cause progressive phlegmon, and often death, if radical measures are not taken to prevent it.

In this connection, attention may be called to the Hydrozone of Marchand as a specific for these diseases.

On Spontaneous Generation.

By C. A. McCAMM.,

ST. PAUL, MINN.

Beginning with Aristotle and for twenty centuries after him, men found no difficulty in believing in cases of spontaneous generation. They even believed that creatures as high in the scale of being as the frog were products of spontaneous generation. The discovery of the microscope dispelled a vast number of the beliefs that were held concerning it but also brought into view a world of life composed of creatures so minute as to suggest the probability of a passage from atoms to organisms. The difficulty in assigning an origin to the multitude of life found in liquids exposed to the air and in stagnant pools led to this theory. The scientific world was until late divided into two hostile camps upon this subject. Among the upholders of the theory were Buffon and Needham and later F. A. Pouchet in France and Dr. Bastain in England. Among its opposers were Francesco, Redi and later Pastuer and Tyndall.

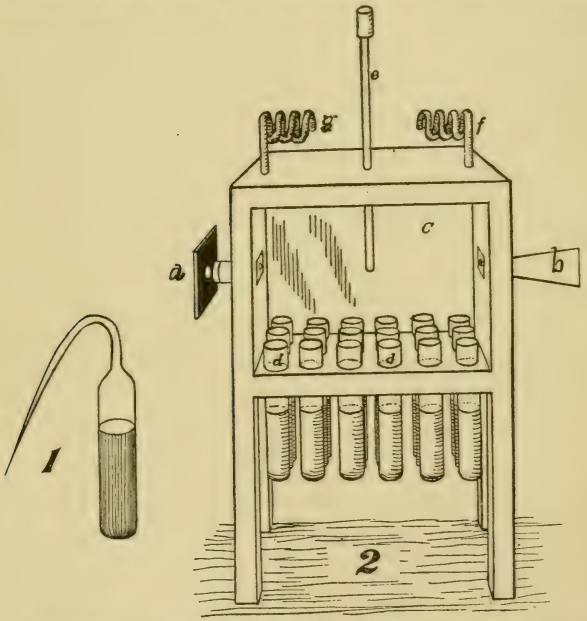
Redi proved that the magots which are found in putrefying flesh were produced by the flies which are always found buzzing around the meat and alighting on it. The magots, he thought might be the half developed progeny of the flies. The guess led to experiments which established its truth. But it remained for Tyndall to give the death blow to this theory. After years of most careful, intelligent and laborious experimenting he proved that the formation of bacteria was not the result of vital forces at work in the infusion itself but was due to contact of particles, which are found floating in the air, with the infusion.

He prepared sixty flasks containing infusions of beef, mutton, turnip and cucumber; these he packed carefully and transported to the Alps. The infusions were pre-

pared in the Royal Institution in London. He covered the substance from which the infusion was to be made, with distilled water kept at a temperature of 120° Fahr. After digesting the substance for four or five hours, he poured off the liquid, boiled it, filtered it and obtained a clear infusion. The liquid was then cooled and its specific gravity found. The flasks used were similar to that shown in Figure 1. These were filled by placing the tube in the infusion, heating the flask and then chilling it. The air within then condenses and is followed by the infusion. The flasks were then plunged in the boiling oil for five minutes, the steam escaping by the open neck. While the steam was still escaping a Bunson flame was applied to the neck and sealed it by melting the glass. The flask is then drawn from the oil perfectly sealed hermetically. Aster arriving at the Alps, 54 of the 60 flasks were found to be clear, the other 6 muddy but these on being carefully examined were each one found to have the nip of the neck broken off and hence admitted some air. The infusion in the muddy flasks was found to be crowded with life but which could not have been the result of spontaneous generation; or, if so, how account for the clearness of the 54? The fact that air was admitted into the 6 muddy ones and that these alone showed life tends to show if it does not prove that in this case ordinary air was necessary to the production of bacteria. But to prove that it is not the air itself, but something present in the air which produced the life, Tyndall went further. He divided the 54 clear flasks into groups of 23 and 27; the 23 he carried into a hay loft and broke off the ends of the necks admitting air. He then carried the 27 to a greater elevation in pure air and taking precautions lest any dust from his clothing or from the nippers should enter the flasks he nipped off the ends of the 27. He then placed the 50 flasks over a kitchen stove in a temperature varying from 50° to 90°

Fahr. and in three days he found 21 of the 23 flasks opened in the hay mow crowded with life. After three weeks of exactly the same conditions to which the 23 were subjected not one of the 27 had given way. The inference here is that it was not the air of the loft but something present in the air which produced the results observed in the 23 flasks.

For nearly 10 years, as he was able, Professor Tyndall was engaged in a study of the effects of radiant heat and



light upon gasses and his studies led to an important discovery. In a beam which illuminated the dust in his laboratory, he placed an ignited spirit lamp and around its rim were seen rims of darkness like an intensely black smoke but which was proved not to be smoke for a hot poker and a smokeless alcohol lamp produced the same appearance. The blackness was that of stellar space or the blackness resulting from the absence of all matter which could scatter light. The flame destroyed the float-

ing matter around it and the hot air from the flame arose into the beam and pushed aside the illuminated particles and substituted its own perfect transparency.

Tyndall brought this discovery to bear upon the study of spontaneous generation. He reasoned that if an infusion, barren, but susceptible of putrefaction when exposed to ordinary air was brought into contact with this non-luminous air it would never putrefy. To prevent the objection; that oxygen passed through a spirit lamp flame looses its vitalizing properties he performed the following experiment: a condensed beam was sent through a large flask containing air; the light revealed the dust in the jar. The jar was corked and left for a few days and examined with the luminous beam; no track was visible, the floating matter had settled on the sides of the vessel. Here he found a way of ridding the air of its floating matter without burning it. He then constructed wooden chambers (*c*) having glass fronts, side windows and back doors. Through the bottom of the chamber test tubes (*dd*) were passed air tight, their open ends within the chamber (*c*). He connected the inner and outer air by means of sinuous channels (*f. g.*) through which air could pass but no dust. A pipette (*e*) entered the chamber from the top. Every precaution was taken to prevent dust from passing into the chamber. The chamber was then closed and permitted to remain quiet for two or three days. Examined at the beginning by a beam sent through its windows (*a. b.*) the air was found laden with floating matter which in three days had wholly disappeared. The inside was coated with glycerine to prevent it rising again. The fresh liquid was introduced into the tubes by means of the pipette. The tubes were then put into a bath and contents boiled to destroy the infection which it had received from air before it was put in the tubes.

With such chambers, Tyndall tested infusions of the

most varied kind including natural animal liquids and the flesh of domestic animals, game, fish and vegetables. More than 50 chambers, each with its series of infusions, were tested, many of them repeatedly. The results were conclusive. In every instance he had perfect sweetness within the chamber which in some cases lasted more than a year. Without the chamber, with like infusions there was putrefaction and decay.

The conclusion here is: that an infusion deprived by heat of its inherent life and placed in contact with air cleansed of its visibly suspended matter has no power to generate life. But a further test was applied which clinched the argument. The tubes had remained in the chambers from 3 months to a year perfectly clear. The doors of the chambers were thrown open and the dusty air allowed to enter and in a few days the infusions were swarming with life. The liquids were therefore proved ready for putrefaction when the contaminating agent was present.

These experiments were so conclusive and so comprehensive that they gave a quietus to the doctrine of spontaneous generation.

The value of these results is seen from the immense practical benefit which has already accrued to science. Prof. Lister applied the principle to surgery with the result that operations, which 50 years ago involved elements of great danger and uncertainty can be to-day performed with perfect safety. Pasteur saved the silk industry of France through this principle and it is being applied to diseases with the prospect of furnishing an insight into the causes and of suggesting remedies for the most malignant diseases.

Biological Laboratory of Hamline University.

The British Association meeting for 1894 will be held in August at Oxford, England and Lord Salisbury will preside.

A large attendance may be looked for.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Transmitting Slides.—The tin-boxes in which the typewriter ribbons are packed are 3½ long by 1½ inches wide and make most excellent boxes in which to transmit slides. There is just room enough to insert the slides wrapped in cotton or in blotting paper and no damage can be done by the mailing or by the pressure to which packages are subjected in mail bags. This is of especial importance when slides are sent across the ocean.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

189. *How would you proceed to make a microscopical examination of urine suspected to contain spermatozoa?—C. S. C.*

Pour the urine into a narrow-bottomed wine-glass or similar vessel; let it stand several hours, until the spermatozoa etc., have fallen to the bottom of the liquid. Remove some of the deposit with a pipette, place a drop on a glass slip and apply a cover glass. Use a ¼ inch or 1-5 inch objective. If too much liquid be placed on the slip, the cover glass will slide about too freely. Then apply a small piece of blotting paper to the edge of the

cover and gently remove, by absorption, the surplus liquid. The cover will then lie against the slip so the microscope can be inclined to a convenient angle for a careful examination of the object.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

Ringing Mounts.—For ringing mounts there is nothing neater, cleaner or more convenient for use than liquid shellac. Use the liquid pure without any admixture whatever. While the slide is upon the turn-table apply the liquid with a fine brush and finish with the point of a knife blade. Rings thus finished look almost as if made of solid glass. If a fancy mount is desired, paint a design on the slide and run the ring over it, as above. These rings make a handsome finish, which every one will admire. One can prepare the liquid himself. It may be obtained at a varnish factory or procured from dealers in microscopic supplies.

Leaves of Shepherd's Purse.—This is a very common weed, (*Capsella bursa-pastoris*), and has leaf hairs in the form of a cross and is but slightly inferior to Deutzia as an opaque mount.

Meridum Circulare.—This beautiful diatom may be found in the ooze on the borders of pathways in the woods and in natural parks. I have a gathering obtained in this way that is practically pure and requires no cleaning for mounting.

To be certain that you have this diatom, carry as a part of your collecting outfit a good strong pocket lens and a slide and cover glass, a compressorium or something of the kind. Place a drop of the gathering on the slide and cover, and view with the lens when the characteristic rings will be visible in the fresh material and with them will be observed separate cuneate frustules. The rings are characteristic on account of their width and disposition of the frustules about the center.

Keep Your Eyes Open.—A practical suggestion to the amateur microscopist who is a lover of nature and a devotee at its sacred shrine, is to keep your eyes open and examine every thing you find. Instruction and beauty will be everywhere un-

folded and you will be convinced that "there are sermons in stones and good in everything."

SCIENCE-GOSSIP.

Bacterium Coli Commune is considered by Ekehorn a cause of appendicitis.

Ice Dangerous.—However pure in appearance, ice may contain disease germs capable of development when taken into the system or brought into contact with food or drink. The evils attributed to the temperature of ice may be due to the germs.

RECENT PUBLICATIONS.

The Microscope and Microscopical Methods. By Simon Henry Gage. Fifth edition, rewritten, pp. 165, 8°. Ithaca, N. Y., Comstock Publishing Co. 1894.

The earlier editions of this work by Professor Gage have been so highly appreciated by students and teachers interested in the study of the microscope that a formal introductory announcement of the new edition is not necessary. The fifth edition, now before us, is for the greater part rewritten, more profusely illustrated, and much new and practical subject matter is added.

The book consists of 165 printed pages, the right hand page throughout the book being left blank for the insertion of notes. The subject matter is arranged in 280 numbered paragraphs which are divided into eight distinct chapters. These contain a clear and concise description of: (1) The microscope and its parts. (2) Lighting and focussing, manipulations of dry, adjustable and immersion objectives; care of the microscope and of the eyes. (3) Interpretation of the appearances under the microscope. (4) Magnification of the microscope, Micrometry. (5) Drawing with the microscope. (6) Micro-spectroscope and micro-polariscope, use and application. (7) Slides and coverglasses, mounting, labelling, and storing microscopical preparations. Experiments in micro-chemistry. (8) Photo-micrograph, etc. Bibliography and Index.

In describing the various parts of the microscope and their functions, the greatest care has been taken to make perfectly clear all the terms used in connection with the microscope.

The more difficult technicalities are simplified by the aid of 103 illustrations, mostly original with the author, which gives a freshness to the pages rarely met with in books on this subject. Although it was written as a guide to laboratory students or a "text book on the microscope," it contains such a marvellous amount of concise information on the mechanism of the microscope that it is worthy of a place among the reference books of science.

This book is written by a man of high scientific attainments who is at the same time a devoted teacher. On this account every sentence has been weighed in two balances, first the one of exact truthfulness from a critical scientific standpoint and secondly the one of expression. This careful consideration of the Author has resulted in the production of an almost ideal guide to assist his and other students in acquiring those details in the knowledge of the microscope which he himself has labored so diligently to master. It is a text book that will aid the beginner and assist the teacher. To be sure most of the topics can be found more or less perfectly treated elsewhere, but so scattered and voluminous is the literature on the microscope that none but a *master* could select the "valuable from the worthless" and bring together *all that is essential* in a work of this size.

There are other works on the microscope more pretentious than this, but no other single book thus far written can take the place of this little volume in the library of the student, teacher, or physician who desires to know "how to use the microscope." It is written to instruct and consequently all necessary details are considered at length but in proportion to their importance. It is in the clear exposition of those details which are too frequently overlooked in works on the microscope that much of its excellence lies. The fact that in this little volume a teacher or student can find instruction on the simplest as well as the most profound technical part of a microscope and careful directions for the proper use of this instrument renders it one of the most practical books ever written on this subject. It is indispensible for the amateur and a most valuable aid for the student of science or medicine in the acquirement of a thorough, practical, knowledge of the use of the microscope.—V. A. M.

THE MICROSCOPE.

Contents for March, 1894.

Objects Seen Under the Microscope. IX.—Various Forms of Bacteria Supposed to Cause Disease. (Illustrated) 33
On Spontaneous Generation. McCamm. (Illustrated) 39
EDITORIAL.—Transmitting Slides 44
QUESTIONS ANSWERED.—No. 189, by Dr. S. G. Shanks 44
189. Examination of Urine 44
PRACTICAL SUGGESTIONS.—by L. A. Wilson 45
Ringing Mounts 45
Leaves of Shepherd's Purse 45
Meridum Circulare 45
Keep Your Eyes Open 45
SCIENCE GOSSIP.—Bacterium Coli Commune 46
Ice Dangerous 46
RECENT PUBLICATIONS.—The Microscope and Microscopical Methods. Gage 46

THE MICROSCOPICAL JOURNAL.

Contents for March, 1894.

Studies of the Histology of Various Mammalian Tissues. Osborn. (Illustrated) 65
Red Snow as Seen by Means of the Microscope. Edwards. (Illustrated) 70
Diatoms of the Connecticut Shore, VI. Terry 74
On Cements for the Microscope, by Arthur M. Edwards, M. D. 83
A Club Working Case, by A. T. Elwell. (Illustrated) 86
EDITORIAL.—The Use of Formalin in Hardening and Fixing Tissues 87
MICROSCOPICAL APPARATUS.—Price of Zeiss's Objectives 88
Substage Attachment 89
MICROSCOPICAL MANIPULATION.—Transmitting Slides 89
To Centre a Slide 89
To Cut Hard Chitinous Objects 90
To Mount Protozoa 90
MEDICAL MICROSCOPY.—Cauterizing Wounds 91
Amoebæ 91
BACTERIOLOGY.—Gunther's Bacteriology 91
Bacterium Coli Commune 92
DRUG AND FOOD ADULTERATION.—Dilution with Tumeric 92
MICROSCOPICAL NOTES.—Directory 92
Ice Dangerous 92
Herbert Osborn 92
DIATOMS.—How to Find Diatomaceous Earth 93
MICROSCOPICAL SOCIETIES.—San Francisco, Cal., Geo. Otis Mitchell, Secretary 94
Washington, D. C., L. M. Mooers, Secretary 95
Lincoln Microscope Club, Roscoe Pound, Secretary 95
Ottumwa Microscopical Society, Ottumwa, Iowa 96
NEW PUBLICATIONS.—The Microscope and Microscopical Methods 96

THE MICROSCOPE.

APRIL, 1894.

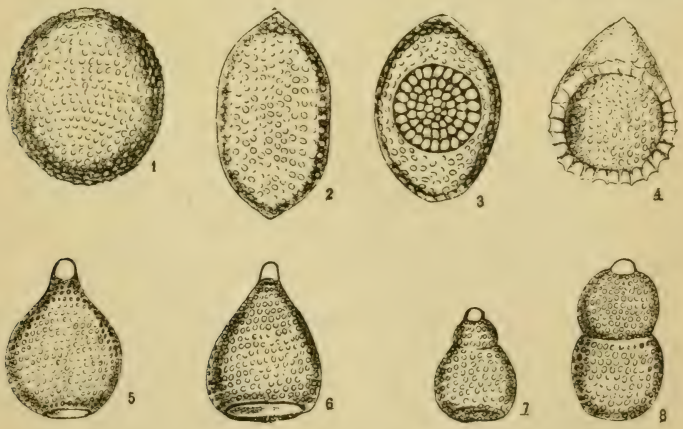
NUMBER 16. NEW SERIES.

Objects Seen Under the Microscope.

X.—SOME NEW FORMS OF RADIOLARIA.

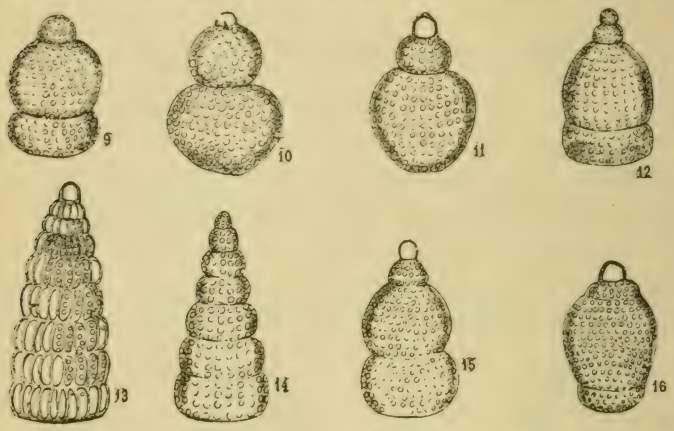
(FROM MANITOBA.)

To those not acquainted with the subject, we may say that these cuts illustrate the fossil skeletons of certain very minute and very low forms of animal life. The animals lived many thousand years ago and only their hard parts remain. Pictures of the animals when living



would look very differently. The Latin names of all these 16 different forms are of no popular interest but they may be found by those who desire them in the *Amer. Mo. Microscopical Journal* for April, 1893, where a description of each is also recorded. We insert these illustrations here to draw attention to the subject. Rev.

F. B. Carter has just finished in the *Journal* for April, 1894, a series of articles on the Radiolaria which are illustrated by 47 figures and which every one should have who wants to study Radiolaria. We have a few pieces of earth containing these forms which we will send out as premiums for new subscriptions. Directions for getting the forms which are too small to be seen until after



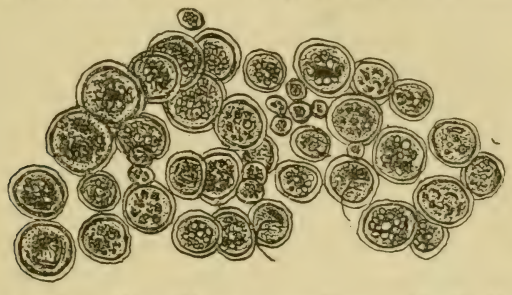
they have been dissolved out by chemical action may be found in the MICROSCOPE for February, 1894, page 29.

This earth was discovered in 1892 by the Canadian Geological Survey at Bell river, Porcupine mountain, Manitoba and sent to Germany for examination.

XI.—RED SNOW.

The objects figured below do not look much like red snow but they are highly magnified, and present a very different appearance in Nature. Every one is familiar with the green coloring often given to fences, stones, trees, etc., which are hidden from the sun's rays. The shaded side of houses, tree-trunks and walls is the favorite resort for the *Protococcus*. Suppose this growth red instead of green and suppose it located on ice or snow in the Arctic regions and you will have pictured to your

imagination what Red Snow looks like in Nature. But to know what it really is, consult an article in the *Microscopical Journal* for March, 1894, page 70 by Dr. A. M. Edwards of Newark, N. J., or you will find something in



Carpenter and in the Encyclopædias. Until the microscope revealed its true vegetable character and its mode of growth, the red snow was one of the omens of evil and gave rise to many superstitions.

Guano Examined Microscopicaly.

By ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

To the younger microscopists of today the idea of examining by means of the microscope, the substance guano seems rather strange but it must be remembered that a true microscopist turns his searching wonder tube on everything. He searches the earth below him and finds wonders. He turns the tube to the waters and he sees them teeming with life. So he looks at the things that are common and finds in them worlds of amazement and delight. To the older microscopist a slide labelled "Guano d'Ichaboe" brings back the pleasure of the preparations of Bourgogne—he is gone now and sons, perhaps grandsons, occupy his place. But what is guano and what does the microscope tell us about it? And remember that the microscope, either simple or compound, is only a magnifying eye, an instrument making the eye,

and the mind too when it is properly used, more searching. If we look in an encyclopaedia to see what guano is, we find something like the following: We find that it is the excrement of birds and other aquatic animals that is found on the islands, more particularly in Peru in the Pacific Ocean, reddish in color and smelling strongly of ammonia and which is brought home by vessels for the use of the farmer as a manure. It was brought home by Humboldt in 1804, being found by him at the Chincha Islands and was in use during the 17th and 18th centuries by the inhabitants of Peru. It was analyzed by the German and French chemists Klaproth, Fourcroy and Vauquelin. But it was not until the publication in 1840 by Leibig of his work on agricultural chemistry that its uses in agriculture were proved. In 1850, no less then 500,000 tons were imported into England from Lima and it sold at about £13 per ton. An interest commercially in money value showed how important it was. Now it is being exhausted and although guano has been found elsewhere as at South Africa, (hence the name Ichaboe) and in the mid Pacific and in the Carribean sea it is now scarce to what it was. This is all very fine commercially, but why does the microscope turn to it to view it?

Some years since my attention was called to the subject of guano when engaged as an analytical chemist in examining the fertilizers of different kinds and thereafter when studying the Bacillariaceæ (or Diatomaceæ, as they are commonly but wrongfully called), and their applications to geology. At last I came to the conclusion that the prevelant notion with regard to the origin of guano was erroneous, for I wanted to find out the why and wherefore for all things. That was my failing, if I may call it so. My ideas of the subject were embodied in a communication made to the Essex Institute of Salem, Mass., on the 4th of January 1869, an abstract of

which will be found in the bulletin of the association, vol. 1, page 11. Subsequently with the Hon. E. G. Squier and Dr. A. Habel, who had visited the celebrated Chincha Islands, and there observed facts which confirmed the present writer's notions with regard to it, he again brought out the subject before the public at a meeting of the New York Lyceum of Natural History, held May 1, 1871. (Proceedings Lyceum Natural History, N. Y., vol. 1, page 224). Therein it is shown that guano is most likely not the excrements of birds and other similar animals deposited upon the islands and main land, but it is the result of the accumulation of the bodies of animals and plants, for the most part minute ones, Bacillariaceæ or Diatomaceæ making up the most part of the mass and subsequently upheaved from the bottom of the ocean by volcanic agency.

Dr. Habel who had visited the Chincha Islands for the purpose of studying geologically the mode of formation of the guano, said it presented itself as strata looking as if it had been laid down beneath water, and the uppermost portion was of a different character entirely. The strata are white and yellow varying in shade and thickness. The dip of the strata varies from five to fifteen degrees. The present writer said he brought the matter before the public first at a meeting of the American Microscopical Society in 1869, and had been fifteen years studying it as bearing upon the origin of certain infusorial earths which occur on the Pacific Coast as at Monterey and Los Angeles, and which extend into the State of Washington. These strata or shales are light in color being nearly white or salmon colored and contain the remains of Bacillariaceæ or Diatomaceæ and Polycistina. Along with these shells there is asphaltum present. But this is present also in Infusorial Earths at other points, as at Trinidad. The California State Geological Survey called the strata bituminous shales. Guano is not found

on the islands alone but on the main land and not only in rainless districts but in other districts, as in Alaska. The Chincha Islands have been visited by Mr. Kinahan, a competent geologist of Dublin also, and he has pointed out that they have been upheaved by volcanic agency within a recent period geologically speaking. Also the details of a residence at the same Island by Mr. F. Nash who states that the anchors of ships bring up guano from the depths of the sea. He says that an Island near Callao which was raised some years since by volcanic action had guano on it. The Bacillariaceæ or Diatomaceæ in guano are peculiar being very beautiful. At Ichaboe, in South Africa, they are brilliant discs seemingly of all the colors of the rainbow, but belonging to the genera *Actinocyclus Ehrenbergii*, *Coscinodiscus* and *Triceratium*, marine apparently beyond a doubt. Some day the ocean in these parts, on the coast of Peru, will be dredged to get the guano that is laying there.

Program of the Tenth Annual Soiree of the Washington Microscopical Society for May 8, 1894.

ADDRESS BY THE PRESIDENT, - - - DR. EDWIN A. GIBBS.

"THE USES OF THE MICROSCOPE."

Illustrated by Lantern Pictures.

EXHIBITS.

1. Cancer, of muscle.
2. Miner's lung (anthracosis pulmonalis), showing deposit of carbon in lung tissue. } DR. G. N. ACKER.
3. Anthrax bacilli in kidney of guinea pig.
4. Yeast fungus (saccharomyces cerevisiae). } DR. W. W. ALLEGER.
5. Section of lymph gland of calf. DR. E. A. BALLOCH.
6. Section of granite, showing component minerals, feldspar, quartz, mica, etc.
7. Macroscopical specimen of same rock. } MR. WM. BROMWELL.
8. Fatty acid from fish oil (by polarized light).
9. Scales of ferns (by polarized light).
10. Sections illustrating histology of human eye.
11. Sections of cancers.
12. Specimens illustrating pathology.
13. Sections of woody stems. } MR. HENRY H. BROWN.

14. Parasite of house fly. — Mr. E. H. Booth.

15. Chain and sheet lightning. — Mr. F. T. Chapman.

16. Male mosquito, (culex pipiens).
17. Scalariform ducts, (root).
18. Medullary rays, (woody stem).
19. Pond life.
— Mr. P. C. Claflin.

20. Blood corpuscles of frog (double stained). — Dr. A. B. Coolidge.

21. Tongue of bumble bee. — Dr. H. A. Dobson.

22. Bud of moss rose.
23. Corolla of heliotrope.
24. Transverse section of bud of tiger lily.
25. Sori of ferns, showing development.
26. Anatomy of a leaf.
— Mr. H. H. Doubleday.

27. Crystals of silver nitrate, ammonium sulfate, copper sulfate, and sodium thiosulfate; also crystals in mica, all mounted in mica (by polarized light).
28. A colony of vorticella.
— Dr. Richard Foster.

29. Vorticella. — Mr. John Grinstead.

30. Renal casts of Bright's disease (chronic parenchymatous nephritis). — Dr. H. H. Hawxhurst.

31. A series of slides
32. illustrating various
33. species of hydroids.
— Mr. W. P. Hay.

34. Section from tumor of ovaries. — Dr. H. L. E. Johnson.

35. Transverse section of spinal cord (human). — Dr. J. Melvin Lamb.

36. Bacillus diphtheriae (Klebs-Loeffler). bacillus. — Dr. Collins Marshall.

37. Cyclops with parasites. — Mr. L. M. Mooers.

38. Web of frog's foot injected, showing the distribution of the lymphatics and blood vessels. — Dr. V. A. Moore.

39. Vase of flowers composed of diatoms and butterfly scales.
40. Trichina spiralis.
41. Transverse section of bone (human) stained.
— Dr. Robert Reyburn.

42. Section of kidney (human), injected.
43. Polycystina, collected off the coast of the Barbadoes Islands.
44. Nematoid worms (coccidium oviforme) in liver tissue.
— Dr. J. H. Rindlaub.

45. Head of cock roach, (blatta orientalis).
46. Slide of arranged diatoms. — Dr. H. W. Rollings.

47. Cheese-mite (tyroglyphus siro). — Mr. W. E. Schneider.

48. Pond life. — Dr. W. H. Seaman.

49. Wood section Wellingtonia gigantea.
50. Section, stem of clematis. — Dr. E. G. Seibert.

51. Duodenum of frog (injected). — Dr. D. K. Shute.

52. Head of house-fly (musca domestica). — Dr. J. T. Sothoron.

53. Fat crystals (by polarized light). — Dr. Thomas Taylor.

54. A series
55. of slides
56. illustrating
57. various
58. forms of
59. plant structure. — Mr. A. F. Woods.

60. Butterfly scales, arranged in a bouquet.
61. Genesis chapt., 1, (Darwin).
62. Wing of diamond beetle.
63. Section of stem of dog rose, through spine. — Mr. J. M. Yznaga.

Each exhibit will have a card numbered to correspond with its number in this program.

The Microscopes Used in this Soiree are as Follows:

Of American Manufacture.	Of Foreign Manufacture.
Bausch & Lomb, McIntosh, Queen, Wales, Zentmayer.	Beck, Crouch, Hartnack, Seibert, Reichert, Swift, Zeiss.

Suggestions for Cell Making, Mounting with Glycerine and Finishing Mounts.

By MAGNUS PFLAUM,

PITTSBURGH, PA.

[Roster of a demonstration before the Microscopical Society Feb. 13, 1894.]

I.—APPARATUS AND MATERIALS REQUIRED.

A.—For cell making.

APPARATUS.	MATERIALS.
Turn table.	Clean slips.
Spirit lamp and stand.	Asphalt cement.
Small vessel for melting paraffine.	Bees wax.
Camel-hair pencils.	Paraffine.
Small strips of common writing paper.	Mucilage.
Scissors and forceps.	Gum tragacanth.

B.—For mounting.

Fine dropper.
Strips of blotting paper.
Heavy camel-hair pencil.
Saucer for distilled water.
Glycerine, C. P.
Shellac cement.
Gold size, quick drying.
Cover glasses.
Distilled water.

C.—For Finishing.

Cut-edged needle.
Zinc-white cement. Benzole.
King's Lacquer cement. Alcohol.

II.—CELL MAKING.

1. Date: write with lead pencil upon common white paper, mucilage *upon writing* and paste upon upper edge of slide on *under* side.

2. Put slide upon turn-table.

3. Ring with asphalt cement, width of intended cell. Allow to set.

4. Cell of hot paraffine and bees wax of thickness to suit.

5. Ring of asphalt cement to cover cell substantially, especially inside and outside where attached to slip.

6. Put aside to set and dry.

III.—GLYCERINE MOUNTS.

A.—WITHOUT CELL.

1. Date as above.
2. Clean slip upon turn-table.
3. Ring of quick drying gold size smaller than cover glass.
4. With dropper, small quantity of glycerine.
5. Place object in position.
6. Cover with glycerine, mound to be slightly higher than ring.
7. Put cover glass in position, slanting.
8. If air bubbles, rotate cover glass with clean gum of (gum tipped) pencil in direction of bubble to edge until edge is reached.
9. Continue as "with cell B 8," &c. &c.

B.—WITH CELL.

1. Date as above.
2. Place cell upon turn-table.
3. Ring crest *rim* of cell with quick drying gold size.
4. Put in cell small quantity of glycerine.
5. Place object in position.
6. Put over sufficient glycerine giving a mound higher than cell.
7. Place cover glass in position. Press down with rubber of pencil.
8. Remove surplus glycerine with dropper.
9. Remove the balance with strips of blotting paper.
10. Wash slide with distilled water using camel-hair pencil.
11. Dry slide with blotting paper.
12. Use spring clip with care not to move cover glass.
13. Put aside to set and dry.

IV.—FINISHING.

1. Date as above.
2. Place mount upon turn-table.
3. Ring with shellac cement.
4. Put aside for thorough drying.
5. Place mount upon turn-table.
6. With cut-edged needle cut away any irregularity in outer edge of shellac ring.
7. Cover with zinc-white cement.
8. After about 5 minutes ring with any color of lacquer cement (King's) to suit taste.
9. Put aside to set and dry.
10. In about a week polish slide, put on labels, copying any dates of importance you choose and remove date slips from under side by wetting.
11. Result: a beautiful slide.

The Size of a Spider's Thread.—Leuwenhoek, the first microscopist, wrote in 1685 as follows:

I have often compared the size of the thread spun by full grown spiders with a hair of my beard. I placed the thickest part of the hair before the microscope and from the most accurate judgment I could form, more than a hundred of such threads placed side by side could not equal the diameter of one such hair. If, then, we suppose such a hair to be of a round form, it follows that 10,000 threads spun by the full grown spider, when taken together will not be equal in substance to the size of a single hair.

To this, if we add that 400 young spiders, at the time when they begin to spin their webs, are not larger than a full grown one, and that each of these minute spiders possess the same organs as the larger ones, it follows that the exceedingly small threads spun by these little creatures must be still 400 times slenderer; and, consequently, that 4,000,000 of these minute spiders' threads cannot equal in substance the size of a single hair.

The British Association meeting for 1894 will be held in August at Oxford, England and Lord Salisbury will preside.

A large attendance may be looked for.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

An Anti-Dissection and Vivisection Writer.—One of the kindest hearted of men is Geo. T. Angell and one of our most enterprising exchanges is "*Our Dumb Animals.*" It contains many nice little stories of kindness to animals, of sagacity, etc. Whatever it says and does in a gentle spirit is mostly good. But, by reason of unbalanced thought, many flies are mixed in the ointment. This kind hearted man sometimes seem devoid of common sense when he attacks cruelty, real or imaginary. Along side of the beautiful persuasive stories; he prints the most infamous rot regarding vivisection, dissection, check-reins, etc. At the same moment, the paper is a white-winged messenger of peace, and a crazy bomb thrower. Thousands, who could be benefitted and pleased by its virtues, will discard it in disgust as of "no good" when they see its faults. By its indulgence in crankiness it curtails its power for good many fold, greatly to our regret. Why be so unbalanced in your thoughts, Bro. Angell? You violently antagonize the work and opinions of men of high standing, when, were you more modest you would go slower. You alienate the sympathy of many influential men when you ought to prize it. You make statements so exagerated as to tempt people to give you the lie. You say that putting a mouse under a bell-glass and exhausting the air in a public school is "useless, barbarous and demoralizing" *to the teachers.* You say "it might be useful to teach children to carve chickens"

but you denounce all dissection of cats even in high schools because as you say "not over one child in a thousand has a bent for zoology."

Mr. Angell sends out a "beautiful placard" containing the exhortation: "Don't ride in any vehicle drawn by a poor-look-horse," but in all his literature we find no allusion to withdrawing patronage from poor looking men, women or children. Why not be consistent in your folly, Mr. Angell?

Illustrations might be multiplied of these unfortunate lapses in common sense. The one which really led to our writing this article, may close our remarks. In his April number is an article of nine lines headed "Cornell University." He first quotes some one as saying that Prof. Bert G. Wilder in his "Physiological Practicums" has published explicit directions for examining portions of the cat, and the heart, eye and brain of the sheep as an aid in the study of elementary physiology. His comment thereon is: "The whole freshman class at Cornell came near being murdered recently by scientific suffocation, which caused the death of the poor woman serving them." We call on Mr. Angell in the name of every friend of this distinguished anatomist to either withdraw or to justify this inuendo which on its face appears senseless and cowardly.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

190. *Can vegetable sections which contain crystals be mounted in balsam or glycerine, without destroying the crystals?—H. A.*

Plant crystals are commonly composed of oxalate of lime, which is unaffected by balsam or glycerine.

191. *Will you kindly inform an amateur where to find amœbas and stentors, and the method of obtaining them?*

Amœbas and Stentors may be found in shaded, mossy pools of water. In winter they may be found in the green moss growing on the stones etc., in aquaria. Pick up a morsel of the moss with a forceps or small scoop, place it in a small cell or on

a glass slip with a concave centre. Examine with a low power. If the find is rich, lay on a cover and examine the moss and contained water with a ¼ inch objective. See A. M. M. J., vol. X, page 151, for an article on amœba.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Metallic Crystals.—Crystals prepared in the following manner are brilliant and gorgeous opaque objects. The Copper is the most beautiful. They are easily produced and no microscopist should be without a few of these slides, especially when he desires to excite the unfeigned admiration of his friends.

Place on a cover a solution of the chloride of tin, silver, gold, platinum, copper or lead. The tin crystals will be precipitated by placing a little pencil of cadmium on a cover with the solution. Silver may be thus precipitated from the nitrate with arsenic, antimony, zinc, lead, iron or copper. Copper from the chloride with bismuth, zinc, lead, tin or iron.

Gold from the chloride with all those mentioned for silver. The precipitating metal must be a little metallic bar laid on the cover containing the proper solution. Mount in balsam, between two covers, then cement on a bed of asphalt and ring with shellac to prevent the asphalt from running in, and after drying finish with asphalt.

Pollen Tubes.—Claytonia Virginica or Spring Beauty, now in blossom in the woods, furnishes an easy specimen for the exhibition of pollen tubes. In order to see them, sever the style and view the three stigmas. The tubes will be visible in the grain adhering to the stigma. To see them a quarter inch objective will be the most serviceable. All the great works on botany assert that to accomplish fertilization the pollen tube descends into the ovary and comes into actual contact withth e micropyle of the ovule. A few skeptics have doubted the assertion whereat the authorities became wroth and declare that non-experts cannot see or know anything about the matter and nothing but highly expert manipulation can demonstrate the truth. In Claytonia the tube is very distinct and to the non-expert it looks equally as plain that the tube does not descend

to the ovary but that each tube is intimately attached to a stigmatic process, and it looks as if these processes acted as haustoria and that the act of fertilization was carried on by suction and absorption.

Here is a field where the amateur microscopist may win immortality.

Quick Methods of Staining Tubercle Bacilli.—Take the sputum of pulmonary consumption or one of the little tubercles found therein ; thinly spread on cover-glass in air, pass thrice through spirit lamp flame to fix. Stain five minutes in Nelson's Dye, (Fuchsine 1 part, 5-100 aqueous solution of Carbolic acid 100 parts, alcohol 10 parts, mix and filter) wash in acid alcohol (hydrochloric acid 1 part, alcohol 10 parts) until decolorized, dry on hot glass slide and mount in warm pure balsam.

The whole process can be easily completed in half an hour. If a double stain be desired use Baumgarten's Quick Method :

I.—Cover-glass prepared as aforesaid.

II.—Float for three minutes on the following steaming hot, in a watch glass. Aniline aq. 2 parts, saturated alcoholic solutions of fuchsine 1 part. mix.

III.—Then 4 to 5 minutes in the following :

Distilled water 50 parts.

Alcohol 30 parts.

Nitric acid 20 parts.

Methyl Blue to saturation, mix.

ANOTHER METHOD.

Prepare cover-glass as above stated. Stain in warm carbolic fuchsine, then pass the cover-glass to and fro through water at nearly the boiling point until but a faint rosy tinge remains. One or two minutes are usually sufficient and the specimen is ready for immediate examination.

Arranged Scales of Synapta.—A veritable " Oh My " slide can be prepared by arranging the anchors and plates of Synapta as an opaque mount. Mount them on a dark background in a deep cell ; arrange in a circle with the rims of the anchors pointing outward and the plates toward the center. Four plates in the form of a cross in the center, with an anchor at each extremity of the cross and an anchor at each angle will make a beautiful and instructive slide.

SCIENCE-GOSSIP.

The Midland Naturalist, until recently published at Birmingham, England, has been obliged to suspend publication owing to the lack of support. We have not heard of any liquor shops closing for lack of support.

The American Medical Association will meet in San Francisco, June 5, 1894. Odd Fellows hall and 12 smaller halls have been engaged for general and sectional meetings. R. H. Plummer, 652 Mission street will give information.

RECENT PUBLICATIONS.

An Introduction to Structural Botany. By Dukinfield Henry Scott. London and New York. Macmillan & Co. 12 mo. pp. 288, figures 113. Price $1.00

Perhaps you think a dollar book not worth much. In this case it would be a grave mistake, for the book is worth two dollars. Everything about it is in the bookmakers best style.

The author has hit upon an excellent idea—that of describing something in plain language and then giving the technical name. The whole treatise consists of a series of the most lucid definitions but no technical word is used until its meaning has first been made clear in the narative. Hence we pronounce the style simply suberb.

To the microscopist the book is of interest as explaining fully what is to be seen in plant life by means of the microscope though the author alludes to the microscope only incidentally.

Were we starting a class in botany, this book would be our text book. Should some isolated student ask what book to use to enable him to learn plant structure we should refer him to Dukinfield Henry Scott. Should we find young people analizing plants so as to learn their classification, we should tell them to take only the three plants which this book is based upon and read the physiology and morphology as therein set forth as of intensely more interest than the mere naming of a host of plants by external characteristics. We shall await Scott's second volume on the Cryptograms with intense interest. It will be a success.

THE MICROSCOPE.

Contents for April, 1894.

Objects Seen Under the Microscope. X.—Some New Forms of Radiolaria. (Illustrated) 49
XI.—Red Snow. (Illustrated) 50
Guano Examined Microscopically, by Arthur M. Edwards, M. D. 51
Program of the Tenth Annual Soiree of the Washington Microscopical Society for May 8, 1894. 54
Suggestions for Cell Making, Mounting With Glycerine and Finishing Mounts, by Magnus Pflaum 56
The Size of a Spider's Thread 58
EDITORIAL.—An Anti-Dissection and Vivisection Writer 59
QUESTIONS ANSWERED.—No. 190-191, by Dr. S. G. Shanks 60
190. Vegetable Sections Which Contain Crystals 60
191. Where to Find Amœbas and Stentors 60
PRACTICAL SUGGESTIONS.—by L. A. Willson 61
Metallic Crystals 61
Quick Methods of Staining Tubercle Bacilli 62
Arranged Scales of Synapta 62
SCIENCE GOSSIP.—The Midland Naturalist 63
The American Medical Association 63
RECENT PUBLICATIONS.—An Introduction to Structural Botany 63

THE MICROSCOPICAL JOURNAL.

Contents for April, 1894.

On the Means of Distinguishing Human Blood. Tolman 97
Formalin in Bacteriology, With More Especial Reference to its Action on the Bacillus of Diphtheria. Alleger 104
Radiolaria Classification Continued. Carter. (Illustrated) 112
LETTERS TO THE EDITOR.—Blood Corpuscles. Ewell 121
Bird Parasites. Shufeldt 121
The Journal. Lighton 121
EDITORIAL.—Prof. Gage's New Book on the Microscope 122
The Earth Worms 123
MICROSCOPICAL APPARATUS.—Section Cut Versus Natural Preparations 123
MICROSCOPICAL MANIPULATION.—Microphotographs by Lamp-Light 124
Reflected Light 125
MEDICAL MICROSCOPY.—Too Busy to Use a Microscope. 125
Lung Fibers in Sputum 126
BIOLOGICAL NOTES.—Irritability of Phycomyces Nitens. Bay 126
MICROSCOPICAL NOTES.—T. D. A. Cockerell 127
G. W. Rafter's New Book 127
MICROSCOPICAL SOCIETIES.—Washington, D. C 127
NEW PUBLICATIONS.—Investigations on Microscopic Foams and on Protoplasm. Butschi 128

THE MICROSCOPE.

MAY, 1894.

NUMBER 17. NEW SERIES.

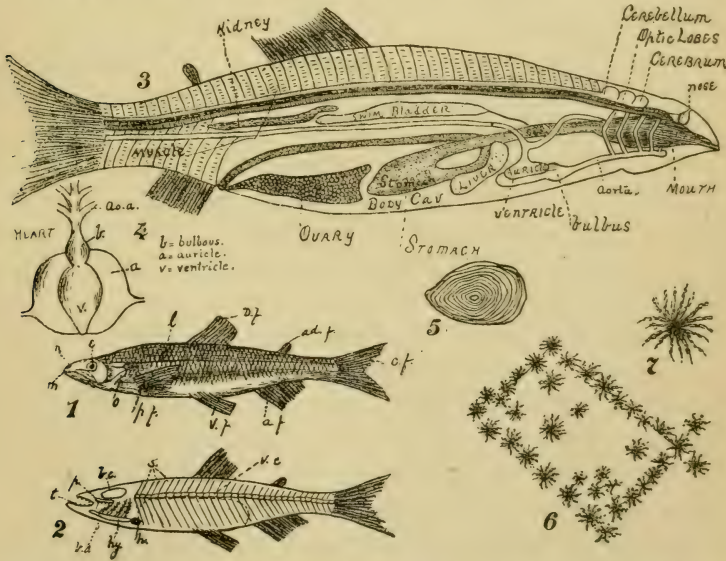
Objects Seen Under the Microscope.

The Smelt (Osmerus mordax.)

BY LAWRENCE E. GRIFFIN & EDITH MONTGOMERY.

Biological students in Hamline University.

The Smelt is a salt-water fish, of the family Salmonidæ, found along the Atlantic shores of the United Sates. Its length is from six to nine inches. The body is nearly



round in cross-section and quite slender. It is dark on the dorsal side, shading into silvery white on the ventral. Extending from just back of the eye to the root of the caudal fin, along each side of the body, is the metal-

lic blue median line, Fig. 1, l. The head is about one-fifth the entire length of the body. The jaws are large and well supplied with teeth which point back toward the throat. The teeth are not set in sockets. The tongue and palate are also armed with teeth.

A thin long flap, the "operculum." at the back of the head covers the gill chamber, Fig. 1, o. This as well as the fins and scales point back, and in this way afford no resistance to the passage of the fish through the water. The sharks and some other fishes have no operculum. In the case of the shark there are on each side, just back of the head, five vertical slits.

The eye is round and without lids; the pupil large and the iris silvery. Near the tip of the nose on the dorsal side of the head, are two pits covered with a thin membrane. These are the nostrils, they do not open into the mouth, (Fig. 1, n).

The fins are divided into two classes, paired and median. The paired fins are the Pectoral and Pelvic fins. The Pectoral fins (Fig. 1 p. f.) are just behind the gill-chamber, while the Pelvic fins are further back and more ventral in position (Fig. 1, v. p). In many fishes these fins are close to each other, the Pelvic fin being sometimes almost immediately under the Pectoral, or, as in the Sole, a little ahead.

The median fins are four in number, viz., the Dorsal on the dorsal line and about half way back, the Adipose fin; dorsal in position and back of the Dorsal fin; the Anal fin, ventral, and just back of the anus; the Caudal fin at the extreme end of the body. The back bone does not extend into the caudal fin (homocercal).

The adipose fin is a fleshy, rayless fin peculiar to the Salmonidæ. All the other fins are rayed, and each fin has always a certain number of rays. Thus the number of rays in a fin helps to determine the species of the fish.

The shape and arrangement of the fins varies much in

different species. In the Cod, the dorsal fin is divided into three distinct parts and the anal fin into two parts. The Bass has an extremely long dorsal fin, extending almost the entire length of the back, and in the Sole the anal fin extends from the anus to the tail, the anus in this case being almost directly under the operculum.

The position of the anus differs very much; in some species being far forward, and in others being far back. In some Australian and Queensland fishes, the paired fins instead of being rayed, have a central bone, with others branching from it in much the same manner as the veins of an elm leaf. The fins are also of nearly the shape of this leaf. The scales are small, and when viewed with the low power appear to consist of concentric rings "cycloid scale" (Fig. 5).

1. In the dermis beneath the scales are situated the pigment cells which give the skin its colors. These may be easily seen by mounting a small piece of the dermis and viewing with the low power. The cells are stellate, of a dark color, and upon the dorsal side very numerous and well developed, (Fig. 7.) but almost lacking on the ventral side. The cells are arranged in diamond shaped groups (Fig. 6). In the dermis are two sets of parallel fibres which cross each other obliquely. These are known as white fibrous connective tissue. They may be seen quite plainly with the high power glasses. When irrigated with acetic acid (1 per cent) the fibres disappear, this being the characteristic reaction of this tissue.

2. The mouth connects directly with the œsophagus, there being no separate throat. Salivary glands are also lacking. The stomach is quite large, and the intestine leaves it at the upper end, makes a half turn, and then runs straight back to the vent (Fig. 3). There is no large intestine and probably no distinct pancreas.

The liver lies just in front of the stomach. A short distance in front of stomach, the ductus pneumaticus,

connects the swimming bladder with the œsophagus. The food of the smelt is composed of small fishes, or, the marine animals. Nereis is commonly found in its stomach. The spleen is a dark colored organ lying above the œsophagus and in front of the swim-bladder.

3. Just in front of and below the liver is the heart. This organ is red in color and has three parts, one auricle and ventricle and the bulbus arteriosus. The auricle is thin walled and nearly surrounds the thick walled ventricle (Fig. 4). In front of the ventricle is the "*bulbus arteriosus*" from which runs the aorta. The aorta goes forward to the gills and sends off a branch to each side, at every pair of gills. The blood passes upward through the gills, and in its passage is aerated. The branches of the aorta running around the gills, form what are known as aortic arches. The blood is gathered at the top of the arches into the dorsal aorta, and by it is distributed throughout the body. The aorta runs along the under side of the back bone to the tail. The small veins collect the blood, lead it to the cardinal veins, and by these it is carried back to the heart. There is a cardinal vein on each side of the body. They are divided into two parts, the anterior and posterior cardinals. The anterior cardinal collects the blood from the head and parts in front of the heart, while the posterior cardinal collects the blood from the regions back of the heart. The cardinal veins enter the auricle upon the right and left sides. By the contraction of the auricle, the blood is forced into the ventricle, from the ventricle to the bulbus and so upon another round.

The portal vein collects the blood from the alimentary system and leads it to the liver. From the liver the hepatic vein takes it to the heart.

4. The gills are the respiratory organs of the fish. Water is taken into the mouth and passed out through the gills. Some of the oxygen is extracted and supplies

the blood in the gill. The gills are soft bodies of a loose cellular structure supported by the branchial arch.

In a few species of fish (e. g. *Lepidosiren*,) the swimming bladder seems to act as a lung. It is filled with a spongy cellular structure, and the blood is passed through this and aerated as in the lungs of mammals. But in most cases this is not so. In most fish the ductus pneumaticus is permanently closed and as this is the only passage into the swimming bladder it precludes the possibility of that organ being used as a lung.

5. The chief use of this bladder is not then as a lung. What effect it has upon the swimming power of the fish is not positively known. It may be that by its contraction or expansion the fish can determine the depth to which it shall sink. It is on the dorsal wall of the body cavity, above the stomach.

6. Just back of the swimming bladder and also dorsal in position is the kidney. This is a dark red, spongy organ, and connected with the anus by a straight duct.

7. The muscles of the back are very strong, while those of the fins are weak. As the fish swims by flexion of the back, and uses the fins mainly for balancing, this development would be natural. In mammals, which use the limbs for locomotion, the contrary is the case. The muscles are made of sets of fibres, and the individual fibres are composed of still smaller parts called fibrils. They are composed as if successive short lengths had been laid down in the process of growth. The whole is contained in a very delicate membrane—the sarcolemma. The successive growths give a striated appearance to the fibril. The high power glass must be used to distinguish these facts. Close to the wall of the fibrils, at nearly equal distances from each other, are nuclei, from which threads of protoplasm extend throughout the fibrils.

8. The brain is composed of the following parts: the

olfactory lobes, cerebral hemispheres, optic lobes, cerebellum and medulla oblongata. The brain is situated between the eyes and is protected by a case of cartilage, and above this by two long, thin and narrow bones.

The olfactory lobes being anterior, the other parts follow in the order named. The olfactory lobes are two in number, right and left olfactories, and connected with the nostrils by the olfactory nerves. The optic lobes, right and left, as on the central hemispheres also, have connection with the eye through the optic nerves.

The eyeball is nearly spherical, and movable in its orbit to a slight degree. The pupil of the eye is the central opening of the iris, which is a pigmented diaphragm stretching across the interior of the eyeball, and about one-quarter the distance from the front of the eye to the back. In front of the pupil is the transparent cornea, and between this and the iris is the aquæous humour, a transparent watery substance. Immediately back of the pupil is the crystalline lens, bi-convex, and surrounded by muscles which can render the lens more or less convex.

The back of the eye-ball is covered with a silvery membrane, the sclerotic coat. Within this is the dark choroid coat. The optic nerve enters a little to one side of the back of the eye and spreads over the inside of the eye forming the sensitive retina. The chamber back of the crystalline lens is filled by the vitreous humour, a transparent jelly-like substance.

The optic lobes are covered by the pia mater; a thin pigmented membrane. The cerebellum is a single mass slightly constricted along the median line from front to back. The medulla oblongata is a little beneath the cerebellum, and extends posterially to the spinal canal, where it becomes the spinal cord.

9, The Spermaries are two large, white bodies, situated in the back part of the body cavity, distinguished

as right and left spermaries. A duct leads from the spermaries to the anus. The ovaries of the female are placed in the same relative position, and are known as the right and left ovaries. The color of the ovaries is yellow, while that of the spermaries is white.

The eggs are found in the ovary in different stages of developement. Some almost fully developed and others in the first stages are totally undeveloped (Fig. 3).

The ova are all enclosed in a fine porous membrane—the vitelline membrane. Among the ova may be seen many minute drops of oil. By placing the ova in ether for a few hours the oil is completely extracted. The undeveloped ovum contains simply the nucleus and protoplasm. In the developed ova the protoplasm has formed a net work throughout the ova, and the interstices are filled with yolk.

10. The back-bone extends from the head to the root of the caudal fin (Fig. 2). It is made up of a number of vertebra. Each vertebra bears two or more spines, according to its position. The vertebra itself is called the centrum, and is, in cross section, almost square. The centrum is slightly longer than it is broad. The ends of the centra are concave and a canal runs longitudinally through the centra. This canal contains the noto cord, a cartilaginous body, which swells out at the junction of two centra and fills the space caused by the concavity of the ends.

From the top of each vertebra rises a spine, (the neural spine.) To form this spine it seems as if a spine had grown upward from each side of the centrum, and after a time had joined, forming a canal at the base of the spine, through which runs the spinal cord. Until the body cavity is passed the centrum bears a curved spine or rib on each side. Back of the body cavity there are no ribs, but the centrum bears a ventral spine, shaped as the neural spines, and through the haemal arch runs

the aorta. The gills are each supported by a bony arch, formed by three bones. One extends down and back and out from the roof of the mouth for a short distance. The next is jointed to the first, and runs in and down until under the floor of the mouth, and the next bone joins this to the hyoid bone. These bones form the Branchial Arch and support the soft tissue of the gills. These bones also bear teeth, or gill-rakers, to prevent food from escaping between the gills.

Models for Constitution and By-Laws of a Microscopical Society.—III.

[In 1893 there were presented the Constitutions of the Washington and San Francisco Societies, pp. 69, 133. Others are desired for use in this series.—EDITOR.]

CONSTITUTION OF THE MICROSCOPICAL SOCIETY OF BELGIUM.

ARTICLE I.—GENERAL PROVISIONS.

SECTION 1. This Society is called *La Societe Belge de Microscopie.*

SEC. 2. The object of this society is to cultivate a taste for microscopical studies, to cause the utility of microscopy to be appreciated; to contribute to the progress of science by publications, by making collections and forming a library; and by such other methods as may be deemed expedient. The Society studies the subject of micrography in its widest sense including all the medical, natural and industrial sciences.

SEC. 3. The Society has its headquarters at Brussells.

SEC. 4. The Society can be dissolved only by the consent of four-fifths of its active members. The last general assembly which shall declare the dissolution, shall dispose of the collections, the library and the archives to some scientific establishment.

SEC. 5. There can be no modification made in this article of this constitution without the consent of four-fifths of the active members, called together by the Executive Council in a general assembly convoked especially for this purpose. If in this first assembly there are not a sufficient number of members present

to form this majority so that they can legally transact the business, a second meeting may be called in the same manner as the first, one month from that date, and the questions presented in the same manner as at the first meeting and be decided by a majority of four-fifths of the members present.

The following articles can be changed at a general meeting called especially for this purpose by the Executive Council and with the consent of three-fourths of the active members present at the meeting.

ARTICLE II.—MEMBERSHIP.

SEC. 6. The society is composed of an unlimited number of active and associate members.

The election of active and associate members belongs to the general assemblies after nomination by the Executive Council. A majority of votes upon secret ballot shall elect.

SEC. 7. The Diploma of honorary or corresponding membership can be awarded to persons who have rendered or who are able to render some service to the society. The number of honorary members is limited to fifteen, that of corresponding members to forty. The right of electing honorary and corresponding members belongs to the general assemblies of the society after their nomination by the Executive Council.

The honorary and corresponding members have the same right as the active members to be present at the meetings and to speak upon scientific questions.

No one can become an associate member of the society if he is less than fifteen years of age or more than twenty-four, and associate members are not permitted to participate in discussion.

SEC. 8. Active members pay an annual fee of three dollars; associate members, one dollar; non resident active members can substitute for the annual fee a single payment of forty dollars.

SEC. 9. All members can examine the specimens, books, &c., of the society if they comply with the special regulations. Active and honorary members are each entitled to one copy of the Annals of the Society. Corresponding and associate members are entitled only to the monthly bulletin.

SECTION III.—MEETINGS.

SEC. 10. The members of the society meet in a general assem-

bly upon the second Sunday of October in each year, at 11 o'clock A. M., in the rooms of the Society at Brussells.

The order of business at this meeting is as follows :

1st. To hear the report of the Executive Council upon the condition of the society.

2nd. To audit the accounts.

3rd. To fix the days for the monthly meetings of the society.

4th. To deliberate upon the propositions submitted to it by the Executive Council or which are proposed by any nine active members.

5th. To elect by secret ballot a President, the Vice-Presidents, the Secretary, the Treasurer and the members of the Executive Council.

All decisions made by the general assemblies shall be by the majority vote of all the active members present.

Sec. 11. The Executive Council has the right to call together the general assembly in extra session. It is its duty to do so after one month's notice upon the written request of twelve active members.

Sec. 11½. All calls for extra sessions must be sent to the members at least fifteen days before the date fixed for such meeting. This call must indicate in detail the questions upon which the assembly is to be called upon to deliberate, and no decision can be made upon any questions that were not contained in the program for the day as set forth in the call.

ARTICLE IV.—ADMINISTRATION.

Sec. 12. The society shall be governed by an Executive Council, which shall represent it. This council shall be composed of a President, two Vice-Presidents, a Secretary, a Treasurer, a Curator, (Librarian) and four members.

Sec. 13. It shall be the duty of the Council to take such measures and make such regulations as shall assure the prosperity of the society, order in its work and publications and preserve its collections, library, furniture, &c. Its decisions are valid only when they are taken by the absolute majority of all its members.

Art. 13½. The Council shall elect each year an assistant Secretary and an assistant Curator--Librarian. The duration of

their term of office shall be one year and they shall be eligible to re-election.

The President is elected for two years and he is not eligible for immediate re-election.

The other members of the Executive Council are also elected for two years, one half are to be changed each year and they can be immediately re-elected.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

A Lady Miscroscopist for 50 Years.—We have always taken the ground that the microscope is peculiarly adapted to the fair sex. We have always indulged the hope that among American ladies the use of the microscope would be as common as that of pianos, organs, and that the music of the eye in beholding the harmonious combinations found by microscopy might be equal to the music of the ear produced by vocal and instrumental culture for introduction into the best circles of intelligent society. It is then very pleasant to announce that an English lady, Mrs. Jenny Spottiswoode, 1 Lunham road, Upper Norwood, London, has cultivated for more than half a century the charms, pleasures, delights, intellectual cultures, and uplifting influences of microscopical enjoyment. Fifty such years have not cloyed her tasts as the following extracts from a late letter of her's to an American friend are a proof:—"I think the taste for it (Microscopy) is born with one. It is

distressing to me to show an object to any one who simply tells me "Oh how pretty" and nothing more. * * * * I so often wish you were in England and that we could have a good day's work at the microscope. Photography (micro) is made so easy *now*, to what it used to be when I used to work at it. I have now under the microscope tadpoles and frogs. I love to see *their* internal economy. Intestines are so beautiful and the eye is like a jewel; and its pigment and the whole body masses of jewels; and then the gills are a study of circulation. I have examined the tadpoles of toads and tadpoles of Newts." Her statement shows that love and enthusiasm for micrographic work does not die out with age and must be very desirable when confined at home by an accident impeding locomotion as Mrs. Spottiswoode was at the time of writing. Dr. Holmes said he was eighty years "young" (not old) and he taught me microscopy. So can Mrs. S. say, "I am seventy years young, kept so by the inspiring and enthusing power of the ideas attained by the use of the microscope in studying and comprehending the hidden glories of Nature.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Uncinula necator.— This is the powdery mildew of the grape and is generally known as *Uncinula spiralis* and in Europe as *Oidium tuckeri*. It is easily obtained and makes a beautiful specimen for the microscope. Doubtless, nearly every one has noticed the little cob-webs in the corners and angles of a bunch of grapes. It is almost ever present on grapes kept during the winter. This "cob-web" is the mycelleum and perithecia of the fungus. Take off a small portion with forceps, place on a glass slip in a little hydrate of potasium, cover and examine first with an inch and then with a quarter inch objective. The perithecia are round, dark and prettily reticulated; each has from ten to twelve appendages. These appendages are long and curved at the ends like a shepherd's staff. After softening with the potash solution, press upon the cover. This will split the perithecia and expose the asci. Each ascus contains from four to six round spores. To make an acceptable mount let

eosin run over the specimen as prepared above until the object is flooded. Let it soak from half an hour to an hour. Then with forceps remove to a clean glass slip; then float in alcohol; when the alcohol evaporates float in turpentine and under a dissecting microscope see that the stained film is nicely spread out. Then mount in balsam. You will have a slide worth seeing and one that is not common.

Etching Labels on Slides.—This may be easily accomplished and will produce better permanent labels than can be written with a diamond. Coat a clean slide with bees wax by heating in the flame of a spirit lamp and spreading the film of wax evenly. Trace the design with a needle through the glass, in a little shallow lead dish one half inch deep and four inches long and three inches wide, place a teaspoonful of powdered fluor spar and one half ounce of strong sulphuric acid. Across the top place the slide or several slides, wax side down. Smear the opposite side with vasiline and let it remain over night. In the morning remove the wax with turpentine or chloroform and the label will be permantly etched. Care must be taken while performing the experiment as the vapor of hydrofluoric acid generated is in the highest degree corrosive and its action upon the human system is highly deleterious. The same result can also be obtained in the course of a few minutes by a gentle application of heat to the cup containing the mixture.

To Obtain and Mount an Embryo Chick.—Take eggs that have been partially incubated. By taking eggs which have been set for different lengths the progress of incubation may be watched and studied. To see the embryo, crack the shell upon the side over an area as large as a half dollar; then pick away the pieces of the shell piecemeal without disturbing the tough membrane just within. The latter must be carefully torn away with forceps and the embryo will be found upon the upper surface of the yolk with its axis at right angles to that of the egg, with its head away from the observer, if the smaller end of the egg be toward the right.

With sharp scissors the vitalline (yolk) membrane is pierced and a circle cut about the embyro just about the limiting vein of the vascular area. On immersing the egg in a 75 per cent salt solution at about 99° Fahrenheit, the blastoderm will float and may be slipped upon the slide and with a pipette

gently forced from yolk particles and the overlying portion of the vitalline membrane. It is then drained until flat and without creases, dried with gentle heat until the edges will just adhere to the slide, then immersed in 1 per cent osmic acid for three minutes or until the preparation begins to turn black; it must then be thoroughly washed in distilled water, placed for several days in a considerable quantity of Muller's eye fluid, washed again, passed through alcohols of increasing strength, cleaned and mounted.

Muller's fluid consists of

Bichromate of potassa	2 grammes.
Sulphate of soda	1 gramme.
Distilled water	1 gramme.

The specimen thus mounted is suitable for low powers, a two inch or one inch objective, and is an exceedingly interesting specimen in embryology which will be explained in any good work devoted to that subject.

A Good Way to Mount Mosses.—If the specimen be one that has been gathered for some time, cut a sprig of proper size for mounting, wash the sprig in water, then spread out upon a plain glass slide, wipe away the superfluous water; then cover with another plain slide, bind the two slides with a strong spring clip and set away to dry; let it thus remain at least a week. The specimen will then be dry and the parts will be nicely spread out and displayed. Then place in a shallow cell and mount in balsam. If the moss be green and fresh, first wash in water, then put between the leaves of an old book or in a flower press and leave until dry before mounting. This latter method is good for mounting florets of the Compositæ or Sunflower order of plants.

RECENT PUBLICATIONS.

Sir Francis Bacon's Cipher Story.—Discovered and deciphered by Orville W. Owen, M. D. Vol. 1. Detroit and New York. Howard Publishing Co., 8° pp. 198. Paper 50 cents.

Our author claims to be able to transpose all the plays of Shakespeare, Robert Green, George Peel and Christopher Marlow; the Fairy Queen, Shepherd's Calendar and all the works of Edmund Spencer; the Anatomy of Melancholy of Robert Bur-

ton, and all the works of Francis Bacon into a political history of the times of Queen Elizabeth and that this volume now published is introductory thereto. He claims to do this according to a system called the secret cipher which is concealed in the above-named works, but he does not yet tell us how to work the cipher, so that we are not able to verify any of his work. In the opinion of several prominent literary and scientific men of Washington whom we have consulted, we ought not to place confidence in the cipher stories at present, nor until Dr. Owen has seen fit to allow us to pass judgment upon his methods, or until some one else has given us the workings of the keys.

This volume opens with "Sir Francis Bacon's Letter to the Decipherer," in which we are told something regarding the construction of the cipher but not enough so that any one except Owen has yet done any translating. A writer of this notice has spent some 50 or 60 hours in an effort to understand it but without success.

Our world has accepted much "history" upon the dictum of the historian and may perhaps accept the declaration that Francis Bacon was the son of Elizabeth, wrote all of Shakespeare, killed Shakespeare, bribed Spencer to father the Fairy Queen, knew Elizabeth to have been murdered by Robert Cecil, announced the circulation of the blood in 1612, (four year's before Shakespeare died) while Burton made it public in 1619,—the world may accept all this and much more that Owen has in store, but we, as scientists, apply the scientific method which requires all discoverers to submit for our repetition all the steps of their processes before we assent to their claims. No dark corners for us! If Owen has confidence in his cipher, why not publish it? Because he fears some one would use it and publish the secret history ahead of him and deprive him of the money to be made thereby. If he confesses to a money motive, the same motive may account for the book before us as an invention of Dr. Owen's. The 8 years which he says he has largely devoted to Shakespeare ought to have fitted him for such a task. But we intimate no belief; we merely suspend judgment until put in possession of the secret methods of the cipher.

G. W. Rafter, one of our valued contributors, has recently written a book on Sewage Disposal which has been published by Van Nostrand. We have not yet seen a copy.

THE MICROSCOPE.

Contents for May, 1894.

Objects Seen Under the Microscope. The Smelt (Osmerus mordax), by Lawrence E. Griffin and Edith Montgomery. (Illustrated) 65
Models for Constitution and By-Laws of a Microscopical Society.—III. 72
EDITORIAL.—A Lady Microscopist for 50 Years 75
PRACTICAL SUGGESTIONS.—by L. A. Willson 76
Uncinula necatro 76
Etching Labels on Slides 77
To Obtain and Mount an Embryo Chick 77
A Good Way To Mount Mosses 78
RECENT PUBLICATIONS.—Sir Francis Bacon's Cipher Story 78

THE MICROSCOPICAL JOURNAL.

Contents for May, 1894.

A Method for Orienting Small Objects for the Microtome, by W. McM. Woodworth 129
The American Microscopical Society, by Arthur M. Edwards, M. D. 133
Studies of the Histology of Various Mammalian Tissues.—II, by Henry L. Osborn. (Illustrated) 135
The Aniline Stains, by Smith Ely Jelliffe, M. D 152
EDITORIAL.—Progress 155
Meeting of Michigan State Board of Health, Lansing, April 13, '94 155
MICROSCOPICAL APPARATUS.—A New 1-5 Objective 156
MEDICAL MICROSCOPY.—Work of the Mich. Board of Health in 1894 157
BACTERIOLOGY.—Mice Destroyed by Bacilli 158
Gen. Hawley on Bacteria 159
MICROSCOPICAL SOCIETIES.—Microscope Club, Lincoln, Neb. 159
NEW PUBLICATIONS.—Mosses 159
The Refractionist 159
Practical Methods in Microscopy 160
Kindness to Animals 160
An Introduction to Structural Botany 160

BACK NUMBERS WANTED.

There are several Libraries and subscribers who have written for back numbers of THE MICROSCOPE which are exhausted. For any five of the following, we will give a year,s subscription :

1887, Nov., Dec. 1888, Feb., Mar., Apr., May, Dec. 1889, Jan. 1890, Jan., Feb., June. 1891, Jan., July, Aug., Nov. 1892, April.

THE MICROSCOPE.

JUNE, 1894.

NUMBER 18. NEW SERIES.

Objects Seen Under the Microscope.

XIII.—SECTION OF STEM OF SPRUCE.

(Pen Drawing,)

One of the premium slides prepared by Mr. Sutton, of Philadelphia, is the spruce stem shown in cross-sec-

tion above. It will be interesting to study this in connection with the sections shown in the February number, pp 17-21, and to notice the difference in the struc-

ture of the wood, bark, rays, &c. We will make a present of the slide of spruce to each person sending in an article upon the differences between these four sections. Those articles which are worthy of publication will appear in a subsequent issue of this periodical.

Bacteriological Work in Medical Science.

By J. CHRISTIAN BAY,
DES MOINES, IOWA.

Until the middle of this century, medical science was in want of an explanation of the nature and origin of infectious diseases. The discoveries of Jenner did not have the background that they have now, and it was not until the year 1856, that the first microscopically controlled innoculations were made by Delafond, namely with anthrax. In 1848, the typical germ of this disease had been described by the same savant. Muchlhæuser (1845,) and Leisering (1860,) were the pioneers on the subject of typhoid fever, in the same direction.

Infectious diseases are manifested by a series of alternate phenomena which distinguish them from all intoxications. They are, as a general rule, caused by specific organisms (bacteria,) such as tuberculosis, malaria, typhoid fever, recurrens, cholera, yellow fever, etc., and many similiar diseases of animals are manifestations of their life and activity. When not attacking man or animal, they live in organic matter of various kinds; it is only when circumstances favor their activities that they will attack other organisms. It has been proved that many bacteria produce very poisonous substances. The body has to fight the attack made by these, and medicine can do but little to help the patient. Outside of the body, bacteria are found living in almost every place in nature where animals can live, and it is impossible to avoid coming into contact with them. In all rotten substance, in earth and water, in our clothes and

in our food, bacteria live, feed and thrive, and thus we are unable to avoid them.

The work of the bacteriologist consists in gathering full evidence in regard to the specific organism connected with a certain disease. In the first stages of many diseases— such as pneumonia and tuberculosis, it is of importance to know whether a typical bacterium of the fatal disease is present or not, and in what quantity. This cannot be determined with full evidence by the pathologic diagnosis alone ; when it is united with the bacteriological investigation, certainty may be reached, as sufficient morphological, physiolcgical, and biological characters of many of the typical forms are known in detail, so that comparing is possible. As the disease proceeds, it is often necessary to follow the development of the case. Therefore, the bacteriologist should work hand in hand with the physician.

Bacteriological investigations of air and water in towns or smaller localities (wells, sewers, etc.,) are important, and should be carried out at regular intervals so that the danger of contamination may always be checked. A great number of pathogenic forms will keep alive or actually live in water for a long time ; they will come into the wells from the rottening or otherwise contaminated substances in the ground, etc., and attack the organism either by direct introduction into the body or be transmitted through the air from the surface of the water. It is always important to have an estimate of the bacteria living or able to develop in the water from which we are supplied.

Of almost equal importance are researches on bacteria in the atmosphere. The latter is in very many cases the way of transmission, and important results have been derived from such investigations.

Bacteriological analyses of the ground in certain districts are of importance in and after epidemics ; such

places as are exposed to infection or already infected should always be examined. The results of such analyses have often given good information with regard to disinfection, and the life-history of many pathogenic forms have been made known.

In many cases, milk and other victuals will be subjects of investigation. Experience often shows that milk can transfer many infectious diseases, and that many pathogenic forms of bacteria keep alive in milk. Meat should be subject to constant control, as is, in fact, the case in some countries. Many other articles of our daily food should likewise be examined. It is not untimely precaution or falling into the "bacteria rage" of our age to urge the necessity of controlling grocery stores as well as meat markets. Another place where bacteriological control is necessary, is in the treatment of many drugs.

The question of disinfection is based entirely upon bacteriology.

It is very evident that, though the importance of bacteriology has been and still is often over estimated, it cannot be lost sight of when we know how public health must depend upon its many important results. Almost every day discloses new facts or theories, and there is hardly any department of science in which it is so difficult to follow the progress as just here. But the medical bacteriologist cannot work alone if his work is to bring out hygienic results; he must work hand in hand with the chemist. The combined results of the chemical and the bacteriological water-analysis form the complete hygienic investigation of the water. But, more than this, everybody should receive such information as this, and learn the necessity of disinfective hygiene in public and private life.

The methods of bacteriological work are somewhat different from the work otherwise performed by the physi-

ologist, inasmuch as the bacteriologist must be acquainted with certain important chapters of vegetable physiology. But they are by no means always simple, and they require the same amount of patience that is expected from the man who carries out difficult physiological experiments. First of all, a laboratory with facilities for cultivating and experimenting with the many different forms which come under observation, is necessary. Here the species are determined and experimented with, analyses are made, and first-hand information is obtained. Next to this, comes a suitable chemical laboratory, apparatus for photographing, etc. None of these things are very expensive, and, if once obtained, retain their value.

Protococcus and How to Mount them.

By ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

Red snow, which I have been looking at lately, though one of the first organisms I studied, now nearly forty years ago, I recently reported on in the *Microscopical Journal* and this brought me to raking up what was known on that subject. It also led to my gathering what was published on the Protococcus, that common green slime on marshes and on walls and fences everewhere. I thought that a resume of the researches would be profitable and therefore put them down. I also made some experiments on mounting the Protococcus which is rather a difficult thing to do. For they do not possess any solid wall like my friends the Bacillariaceæ being made up of protoplasm, the most destructable thing we have to make permanent mounts of. But I think I have at last succeeded in mastering the problem and mastering the Protococcus by killing the thing.

For it cannot truthfully be said to be a plant, and it will not be said to be an animal, although the earlier ob-

servers, and some of the later too for the matter of that, called it an animal. It was so lively, swimming about with a vigor that was truly amusing. In time, as plants were studied, their spores were seen to be lively also, and Protococcus was transferred to the vegetable kingdom. For a long time it was bandied about from one kingdom to the other resting nowhere, until it dropped into the catagory of Protista of Hæckel. But this was not permitted to rest easy for it was discovered that many things would be classed as Protococcus and at present we are left in doubt where to place it. If I may be permitted to state what I think are the facts, the Protococcus may stand in a place where they may be plants at one time and animals at another; that is to say, elements of spontaneous generations. For I think it can be demonstrated that they generate without any eggs out of carbonic acid, and ammonia. I know this will be considered heterodox by the older students, but the modern students, who are searchers after truth, will I am sure, bear me out.

If we gather by scraping, by means of a knife, some of the green coating that is on the bark of trees or on stones or on brick buildings and place it in water and examine it by means of a quarter inch lens and a one inch occular, we find a number of spheres or green substance surrounded by a transparent stiff cell wall. When we have a typical Protococcus among the green cells or spheres we will see some begining of cell division. And when we look further we will have some sproutings of what seemed to be algæ, of two or more cells joined end to end with the cells themselves more or less elongated. These latter will not seem to bear any relation to the Protococcus itself, but appear to be algæ. Such was the interpretation of the older observers. But they were mistaken. The spheres are the young of the growing plant and the elongated seeming algæ are the midway

stages of mosses. We can keep this in water and watch it grow, but as it is in water it will never grow into a moss. It wants to be kept out of the sun and just moist, so that we can see it grow into a red stage, wherein the cell contents become red colored. But in this, it must be in the sun and kept in water. Besides it must be kept cold. In winter such a stage is seen and it goes by the name of Red Snow then.

Let us now collect some of the green slime that is so common on the surface of the water of both fresh water and brackish swamps, and examine it by means of the microscope in the same way. We shall find it to be composed of a mass of green things which we find to be individuals of a totally different character. Instead of being at rest we shall find it extremely lively; shooting about in various ways are spheres and various shaped organisms with a point in them of a light crimson elongated, and with a cell-wall thin, but not so thick of white as the Protococcus we have before seen and more visible and not stiff as that. As they swim about they will be seen to advance in the following manner. The front portion will swell and the swelling will pass down across the length of the creature without the creature itself advancing as quickly until the swelled part disappears and is lost or passes off at the end. Another swelling will appear on the advanced end and pass off in the same manner. Another and another will appear and disappear, and this takes place without the organism moving onward at all. Now the organism will move with a revolving motion, slower than the appearance of the swellings. If we look at the organism closely, we will see a bright red spot at one end, the end that advances, looking like an eye. In fact this was concluded to be an eye, and the whole organism itself was thought to be an animal, and was called Euglena, whih is now known to be an organisms--neither animal nor vegetable, but Protista.

So much for the Protococcus; and now how to preserve them for future reference. When examined chemically they are found to be made up of protoplasm colored with green coloring matter. No siliceous or woody tissue is present so that the microscopist is puzzled to fix them and to have a medium which will preserve them intact. For years I have tried various ways of mounting them and even neglected the mounting in carbolic acid for that was unreliable. I think now that I have got a way for mounting Protococcus and even animalcules which are transparent and formed of protoplasm alone. These latter, it is known, must hitherto be studied alive for they cannot be preserved, or at least could not until I tried the process I am about to describe. But I do not claim the process as applicable to animals. I only say that I think they will do with it.

To describe: I take the Protococcus and kill it by a saturated solution of Salicylic acid. This will kill anything be it vegetable or animal or Protista. Then washing the acid with water, I introduce a weak solution of ammonia (household ammonia); to this is added a few drops of a solution of Gum Thus in alcohol, or wood spirit and it is permitted to stand for a day in an uncovered vessel. The ammonia will go off, and likewise the alcohol, in a great degree. We have then a solution of Gum Thus in water. This is evaporated down at the ordinary temperature of the house, 60° F. until we have the Protococcus in a strong solution of Gum Thus. More Gum Thus is added and mounted in the usual manner in which Canada Balsam is used. We have now Protococcus mounted in Gum Thus which is of good color and refractive index, showing the organisms nicely. I have tried this mode with Bacillariaceæ (Diatomaceæ) and found it all that can be wished for. Vegetable and animal tissues can be mounted in it also and I think that we have in it just the medium we wanted.

Models for Constitution and By-Laws of a Microscopical Society.—IV.

[In 1893 there were presented the Constitutions of the Washington and San Francisco Societies, pp. 69, 133. Others are desired for use in this series.—EDITOR.]

CONSTITUTION OF THE LINCOLN MICROSCOPE CLUB, NEBR.

Article I. The name of this organization shall be THE LINCOLN MICROSCOPE CLUB. Its objects shall be the promotion of interest in the microscope and the encouragement of microscopical research.

Article II. Any person, a resident of the city of Lincoln, may become a member of the club upon written recommendation of two or more members and election by a majority of the members of the club present at the regular meeting next after the meeting at which such recommendation is presented. Honorary members may also be elected by the club on nomination by the executive committee.

Article III. The officers of the club shall be a President, a Vice-President, a Secretary, and a Treasurer, who shall hold their office for one year or until their successors are elected. The President and Vice-President, shall be ineligible for re-election for one year after the expiration of their terms of office.

Article IV. The duties of the officers shall be the same as in other similar organizations. But it shall also be the duty of the President to deliver an address at the meeting next after his election.

Article V. The executive committee shall consist of the President and two members of the club to be elected for one year. It shall be the duty of this committee to appoint the place and provide for the program of the regular meetings of the club and to manage its general affairs. This committee shall also have power to call special meetings for the transaction of necessary business

upon reasonable notice in writing to the members of the club.

Article VI. The election of officers and members of the executive committee shall be held on the fourth Tuesday of January in each year. Their terms of office shall commence at the close of the meeting at which they are elected.

Article VII. The initiation fee shall be one dollar, in addition to which there shall be each year thereafter an assessment of one dollar payable in advance. The name of any member two years in arrears for annual assessment shall be dropped from the list of members and shall not be restored until all arrearages be paid or until there be a re-election.

Article VIII. The regular meetings of the club shall be held monthly at a time to be designated by the club.

Article IX. Amendments to this constitution proposed in writing at any regular meeting, may be adopted by a two thirds vote of the members present at the next regular meeting. But the club may at any regular meeting establish By Laws or other Rules not inconsistent with this constitution.

RULES.

1. The President shall call the meeting to order promptly at 8 o'clock P. M., for a short business session.

2. The order of business shall be as follows:

a) Reading of minutes.

b) Reports of committees.

c) Motions, resolutions, and general business.

d) Roll-call.

3. At roll-call each member shall make a brief statement (not to exceed five minutes) in general explanation of the specimens or apparatus he has on exhibition, or he may make a brief oral or written communication (not to exceed five minutes) upon an appropriate topic.

4. The executive committee may provide for occasional formal papers and addresses, or longer communications, from members or others, and the titles of them are in all cases to be previously placed on the program on the blackboard, with the time (approximately) to be occupied.

5. After the roll-call and the papers, if any, the remainder of the session shall be informal, each member examining the specimens and apparatus in which he may be most interested. In this part of the session no "order" shall be observed or maintained.

6. At 10 o'clock the President shall declare the meeting adjourned.

Our Instrument in the study of Natural History.--The report of the recent Conference on Natural History rendered to the Committee on Secondary Studies of the N. E. A., constantly emphasizes the use of the microscope. See

Page 151 (among the necessities for proper Botanical work). "Table room, a good compound microscope magnifying from at least 50 to 300 diameters, and a few ordinary re-agents should be furnished each pupil."

Page 161 (Physiology). "Demonstrations of the histological structure of the various organs require the use of a good microscope, with powers of four or five hundred diameters. It will add greatly to the interest if the teacher is able to make a portion, at least, of such preparations in the presence of the class. If the possession of a number of microscopes renders it possible, it is very desirable that an opportunity be afforded students for making for themselves preparations."

Page 154 (Zoology). "The microscope may well be employed in calling attention to the structure of the scales (of the fish). No better object will ever be found for exciting interest among young naturalists than these scales exhibited by polarized light."

Centrifugation—to separate sediment, is coming into general use among European investigators. A number of instruments are in use for the purpose.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

The Antwerp Exhibition.—The best exhibits of microscopes are by English firms, notably W. Watson & Sons. They show the Van Heurk microscopes which are admirable for scientific research. The lenses are fine and all the parts adjustable with ease and accuracy. They also show slips, mounts, etc., as well as photographic apparatus.

Aluminium.—Its weight is $\frac{1}{3}$ that of iron, $\frac{1}{4}$ that of silver, $\frac{1}{8}$ that of gold. A gun metal casting weighing 53 pounds could be cast in aluminium with only 16 pounds. It is very maleable and can be rolled like gold or silver. It conducts heat and electricity readily. It is not corroded by moisture, sulphur, vinegar, or dilute acids. It is too soft to stand much wear or strain. For use in microscopes it is alloyed with nickel, copper, tin, silver, etc. The oldest aluminium works are only 35 years old. In nature, this metal is very widely distributed. The aluminium bronzes are among the very best as they resist oxidisation, are unaffected by sea water or by ammonia.

A New Biological Microscope.—Messrs. Swift & Son have made an instrument with the posterior limb of the tripod doubled and rotating on a pivot. This gives increased steadiness to the stand and the instrument can be packed in a smaller case. The pivot has a strong spiral spring which prevents it becoming loose and takes up any wear on the bearing surfaces.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

192.—*What is a "spot lens"?*—S.

Carpenter say a spot lens is a condenser with a permanent axial stop fixed in it to cut off the central rays for the purpose of obtaining a dark ground upon which the illuminated object lies. Obviously it is not a desirable accessory. It is a condenser, but having a fixed stop it can only be used for this mode of illumination.

193.—*How many specimen slides for the microscope would be requisite to a complete study of human anatomy?—Science Siftings.*

A *complete* series of mounts showing all the structures and elements of the body, would number many hundreds. A series of about 100 preparations if well selected, would show all the typical and important tissues. Many of the sections would show several sorts of tissues for instance, transverse section of trachea would show hyaline cartilage, involuntary muscle, mucous glands, capillaries and ciliated epitheleum. A section of scalp would show, epidermis and its epitheleum, hair root and sheath, sebaceous and sweat glands, adipose, areolar and elastic tissues. One section each, of kidney, liver, lung, ovary, testis, etc., would show typical structure and enable one to identify the organ, but a *complete* demonstration of all the elements involved, would require dozens of preparations for each organ. About 300 varieties of elements and tissues are studied in a good course in histology.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Foramenifera.—As we cannot conveniently take a stroll to Iceland to collect specimens, we may do it indirectly by entering any drug store, and obtaining a little paper full of the sand that comes in the packages with Iceland moss. This sand is

frequently crowded with foramenifera. A specimen which I examined was full of a species of porcelanous foramenifera. They varied from the size of half a pin head to that of a pea. They were easily picked out of the sand with a moistened needle point or a delicate pair of forceps. Beautiful mounts suitable for a two inch objective can be made of them by mounting on a dark back-ground.

Circulation of Blood in a Lizard and a Tadpole.—Noticing in a glass of water a little lizard about as long as a pin, I removed it to a slide with a ledge. The little animal was very active and would have jumped off the slide had care not been taken to prevent its escape. It soon adhered quite closely to the slide. A drop of water was placed on its head and it was viewed with a one inch objective. In the toes and end of the tail the circulation of the blood was beautifully displayed.

The same thing may be observed in the tail of a tadpole. There is a transparent expansion of tissue on each side of the dark central line of the tail. Place the animal in a cell, keep its head moistened with water and view with a one inch objective. The blood may then be seen coursing through the veins and arteries.

The methods here indicated dispense with frog plates and other cumbersome appliances.

An Easy Method of Examining Lichens.—Soak the lichens in water, then remove one or the apothecia to a slide. Immerse it in a drop of liquor potassa. This liquor dissolves and softens the hymenial gelatine and renders the hymenium more easily separable. Then crush and tease the specimen with a spatula. Remove the larger masses of debris; place a thin cover on the slide and examine with a quarter inch objective. In this way the lichen may be analyzed. There is a little work entitled "An introduction to the study of lichens" by Henry Willey, which will enable the student to trace the specimen to its genus.

For more advanced work the "Genera Lichenum" by Dr. Edward Tuckerman will be found useful. The specimen may be rendered more distinct by a solution of iodine of which the formula is iodine, one grain; iodide of potassium, three grain; and pure water, one ounce. The effect of iodine is to color the

hymenium, and sometimes the spores, blue violet or various shades of red. The medullary layer of lichens is often colored blue by iodine. The plants will well repay the study and instead of being very simple they will be found to be very complicated plants. They belong to the Carposporæ and partake of the nature of both fungi and algæ.

After soaking the apothecium in water instead of crushing and teasing, fill the cup with potassium hydrate. Then with a spatula scrape the inside and place a small portion on a slide. In this way the hymenium will frequently be removed intact and will display the theke, paraphyses and spores.

RECENT PUBLICATIONS.

The Journal of Marine Zoology and Microscopy. Vol. 1, No. 1. Nov. 1893.

This is a biological quarterly dealing with the fauna of British seas; and contains many interesting facts and accurate descriptions, in plain wording and accompanied by original illustrations. Personal observations upon the habits of marine animals, together with notes and short articles upon the numberless problems of shore and ocean life, form leading features. The endeavour is to avoid the technical language too frequently met with in Zoological writings, as well as to keep the pages free from trivialities and thread-bare expositions of text book matter.

The Microscopical section consist of "Studies" which deal in pleasant but *exact* manner with the anatomy, life-history and habits of noteworthy microscopical animals. In this way are treated the Protozoa, the spicular Sponges, the young stages of Zoophytes, Worms, Crustaceans and Ascidians. Thus the studies form a series of most interesting articles of great value, as many of the facts are original, and of a nature not to be met with in ordinary text books.

Two full-page lithographed plates, sketched from life, and of first class execution, are, in each number, devoted to the *original* illustration of the microscopical Marine life treated of in the "Studies." To add to the value of these illustrations, they are often coloured. To ensure accuracy, this is done by hand. There are also reviews, the record of Zoological progress, hints on Microscopical mounting, Exchanges, &c.

THE MICROSCOPE.

Contents for June, 1894.

Objects Seen Under the Microscope. XIII.—Section of Stem of Spruce. (Illustrated) 81
Bacteriological Work in Medical Science, by J. Christian Bay 82
Protococcus and How to Mount them, by Arthur M. Edwards, M. D. 85
Models for Constitution and By-Laws of a Microscopical Society.—IV. 89
Our Instrument in the Study of Natural History 91
Centrifugation 91
EDITORIAL.—The Antwerp Exhibition 92
Aluminium 92
A New Biological Microscope 92
QUESTIONS ANSWERED.—No. 192-193, by Dr. S. G. Shanks 93
192. Spot Lens 93
193. Specimen Slides for the Microscope 93
PRACTICAL SUGGESTIONS.—by L. A. Willson 93
Foramenifera 93
Circulation of Blood in a Lizard and a Tadpole 94
An Easy Method of Examining Lichens 94
RECENT PUBLICATIONS.—The Journal of Marine Zoology and Microscopy 95

THE MICROSCOPICAL JOURNAL.

Contents for May, 1894.

A Method for Orienting Small Objects for the Microtome, by W. McM. Woodworth 129
The American Microscopical Society, by Arthur M. Edwards, M. D. 133
Studies of the Histology of Various Mammalian Tissues.—II, by Henry L. Osborn. (Illustrated) 135
The Aniline Stains, by Smith Ely Jelliffe, M. D 152
EDITORIAL.—Progress 155
Meeting of Michigan State Board of Health, Lansing, April 13, '94 155
MICROSCOPICAL APPARATUS.—A New 1-5 Objective 156
MEDICAL MICROSCOPY.—Work of the Mich. Board of Health in 1894 157
BACTERIOLOGY.—Mice Destroyed by Bacilli 158
Gen. Hawley on Bacteria 159
MICROSCOPICAL SOCIETIES.—Microscope Club, Lincoln, Neb. 159
NEW PUBLICATIONS.—Mosses 159
The Refractionist 159
Practical Methods in Microscopy 160
Kindness to Animals 160
An Introduction to Structural Botany 160

BACK NUMBERS WANTED.

There are several Libraries and subscribers who have written for back numbers of THE MICROSCOPE which are exhausted. For any five of the following, we will give a year's subscription :

1887, Nov., Dec. 1888, Feb., Mar., Apr., May, Dec. 1889, Jan. 1890, Jan., Feb., June. 1891, Jan., July, Aug., Nov. 1892, April.

THE MICROSCOPE.

JULY, 1894.

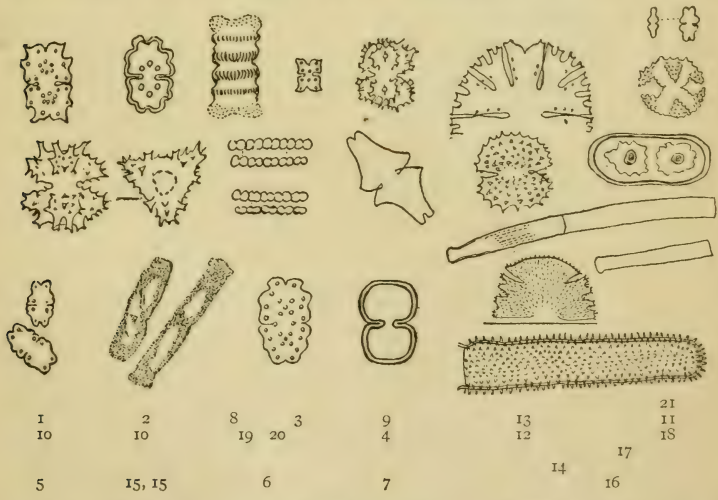
NUMBER 19. NEW SERIES.

Objects Seen Under the Microscope.

XIV.—SOME NEW DESMIDS.

[Pen Drawings.]

The forms shown in the accompanying illustration are mostly new, either as species or as varieties and have been described by W. Barwell Turner, of Leeds, in the *Naturalist*. The group well illustrates to the casual



reader what we mean by desmids, and for students of such forms it is simply designed for a clue to call their attention to Mr. Turner's longer article. The names of the species are, however, appended for the information of those who possess Wolle's or some other treatise on

the desmidiaceæ. For elementary knowledge on these beautiful plants, see Carpenter on the Microscope.

1. Euastrum cambrense.
2. Euastrum snowdoniense.
3. Euastrum binale.
4. Euastrum webbianum f. major.
5. Euastrum crassicolle ?
6. Euastrum anglicanum.
7. Cosmarium gotlandicum v. cambrense.
8. Staurastrum lewisianum.
9. Staurastrum westii.
10. Staurastrum diplacanthum v. anglicum.
11. Staurastrum eboracense.
12. Staurastrum trelleckense.
13. Micrasterias papillifera v. varvicensis.
14. Micrasterias truncata.
15. Penium lewisii.
16. Docidium hutchinsonii.
17. Closterium intermedium v. sculptum.
18. Cylindrocystis roseola.
19. Spondylosium monile.
20. Spondylosium armillatum.
21. Eurastrum exile.

The Microscope in the Dairy.

By PROF. H. W. CONN,
WESLEYAN UNIVERSITY.

The great service that the microscope has been to the brewing and vinting industries in the hands of Pasteur is well known. At the present time no brewery is equipped without its microscope and its microscopist for the purpose of studying its yeasts and obtaining the proper pure cultures of appropriate species for fementation. The great importance of this application of the microscope to the brewing industry is to-day hardly

appreciated because it has become so thoroughly a matter of course. A great brewery would be impossible if its fermentations were simply experiments liable to go wrong. It is not, therefore, too much to say that the gigantic breweries of to-day are possibilities only because the microscope makes their operations matters of absolute certainty.

A similar change seems to be surely coming over the dairying industries of the world, and in almost identically the same lines. We are rapidly learning that the manufacture of the high quality of the modern dairy products of butter and cheese is a matter dependent upon microorganisms, and the production of a high grade of butter and cheese is just as truly dependent upon the use of proper bacteria species as is the production of a high quality of beer dependent upon the use of proper species of yeasts. During the last five or six years several bacteriologists have been undertaking the study of some of these problems and the question of the application of the microscope to butter making seems to be in a very fair way of immediate solution though its application to cheese making has not yet progressed so far. The work upon this subject has been carried on chiefly by Prof. Storch, of Copenhagen, Prof. Weigmann, of Kiel, Prof. Adametz, of Vienna, and in the laboratory of Wesleyan University in this country, by the author. These experiments have been slowly solving problems in butter making which have proved much more difficult than those associated with brewing.

It is an almost universal custom to allow cream to "sour" or "ripen" for some time before it is churned. It has appeared first that the flavor of butter is due almost entirely to certain volatile products making their appearance in the cream during this process of ripening or souring, butter made from cream without such ripening being very tasteless. Further it has appeared

that these volatile products are due to chemical changes taking place in the cream as the result of the active growth of micro-organisms present in it. The chemical side to these changes is at present very little understood, but that the flavor of the butter is due to the products of fermentation is beyond question. It has also appeared that different species of bacteria vary widely in the character of the products which they produce in the ripening cream. Some species will give rise to those exquisitely delicate flavors which are desired in the highest quality of butter, while others give rise to flavors and tastes which are extremely disagreable, producing butter of the very poorest quality and one that would hardly sell in market at any price. Other species again produce changes in the cream which have little or no effect upon the flavor of the butter. Now it is, of course, plain that to manufacture a proper high quality of butter, the buttermaker needs in his cream for the ripening a majority of the best class of bacteria, and it is a matter of as much importance to him to be able to control this factor as it is to the brewer to obtain pure cultures of yeasts for fermenting his malt.

As butter has been made in past years, however, the butter maker has no means of such control. The bacteria that are present in the milk find entrance thereto from a variety of sources in the barn and the dairy, and the buttermaker has no knowledge as to what sources may be depended upon to give him proper species, or what ones to give him those that he wishes to avoid. When the cream is gathered from a variety of sources and mixed together in a large vat for ripening, as in creameries, it is largely a matter of lottery as to whether the cream will contain species that are likely to produce a properly flavored butter or those which will ruin the product. Indeed the buttermaker knows nothing about the subject, and simply allows his cream to ripen under

the miscellaneous collection of bacteria which chance to be furnished him from the various sources from which the cream is obtained. Now if it chances that the proper species of bacteria are present in sufficient quantity, the resulting butter will be of a proper quality, but if, as is frequently the case, improper species of bacteria are present in greater number and the proper species in only small quantity, the resulting butter will be of a poor quality in spite of every attempt made on the part of the buttermaker to improve it.

As our butter is each year being made more and more largely in central stations or creameries, this impossibility of controlling the ripening process becomes a more and more serious matter, and creameries producing several hundred pounds of butter per day are largely handicapped by the presence of improper species of bacteria in the cream. In spite of every precaution taken on the part of the buttermaker or the creamery superintendent, such species cannot be avoided and give a poor quality to the whole creamery product. Difficulties from this source do occur occasionally in the very best creameries, and very commonly occur in creameries that do not pay the strictest attention to the condition of the patronizing dairies. If butter making is to be still further concentrated and produced in creameries in still greater proportion, the desirability of controlling the ripening process becomes greater and greater.

Now as the result of bacteriological experiments a solution of this problem appears to be close at hand. It is theoretically only necessary to find and cultivate the proper species of bacteria and to furnish such cultures to the creameries for artificially inoculating their cream in order to produce a uniform good product. Of course many difficulities arise in the way of the practical application of such methods. The work upon bacteria is much more difficult than the work upon yeasts, and it

proves a matter of much more difficulty to isolate and cultivate the proper species of bacteria for butter ripening than to produce pure yeasts. Still this has been done by at least three of the experimenters above mentioned. Prof. Storch, Prof. Weigmann and the author of this article, have each succeeded in isolating from ripening cream species of bacteria which produce a high quality of butter where used in laboratory experiments. The introduction of these experiments into creameries presents special difficulties and yet difficulties that are being rapidly overcome. Already creameries in the vicinity of the laboratories of the above mentioned experimenters have been furnished with pure cultures of bacteria for the purpose of improving the butter product. The success of the experiments has been marked in each case. In Denmark it is getting to be more or less common to use an artificial ferment for cream ripening. The same is true in certain regions of Germany. In this country the work is more recent, but several creameries have undertaken the use of pure bacteria cultures for ripening cream and with universal success. Wherever the artificial ferment has been used there has been found an immediate and quite noticeable improvement in the character of the butter, and creameries that have once used this method are so pleased with it as to desire to keep it up indefinitely, for they find not only a better butter results, but a much greater uniformity in the quality.

An interesting fact in connection with these experiments is that the species of bacteria used for this purpose by the different experimenters do not appear to be the same or to have any special relation to each other. Cultures used in some places are those producing lactic acid, souring the milk and cream rapidly, while in other localities the cultures that produce good results do not give rise to any considerable quantity of lactic acid and

do not sour the milk or cream. This, of course, indicates that it is possible to obtain a proper result by the use of a large variety of bacteria cultures, and that the peculiar aroma of a good quality of butter is a general decomposition product and not one due to any specific bacteria species. It is also a matter of interest that it is not found necessary to destroy all of the bacteria present in the cream before the addition of the artificial ferment. In many of the experiments, indeed in a majority of those in large creameries, it has only been found necessary to add to the cream ready for ripening a large quantity of the artificial culture, and the large quantity added will find the conditions in the cream such that they can grow rapidly enough to entirely outweigh the effects produced by the slower growth of other species that may be present. Consequently in the experiments in our creameries it has only been found necessary to collect the cream and then to add a considerably large quantity of an artificial ferment thereto and the proper result is obtained at once.

Of course this work is wholly new, but the success that has attended the experiments where they have been tried is so great as to give us almost certainty that a few years further will see in the dairy industry a new application of the microscope to practical life. The manufacture of these artificial ferments will some day be a commercial industry, and is an operation involving more or less use of the microscope. The discovery of the ferments and their action upon dairy products is, of course, wholly due to modern microscopical methods, and thus we find here a new and entirely unexpected use of the modern microscope.

Potassium permanganate is a newly discovered antidote to potassium cyanide. Administer one-half litre of a three to five per cent solution internally.

How I Got Tourmaline for my Microscope.

By HANS M. WILDER,
Philadelphia, Pa.

I went to the "only" Foote and got a lump (small one) of rather light colored (quite colorless) Tourmaline for about twenty cents, and proceeded forthwith to reduce it to a "film;" easily thought, but unmindful of my musty mineralogy, I put a sharp knife, fortified with a smart blow with a hammer, on to one side of the lump, hoping to cleve it somehow. As was to be expected, I merely reduced it to fragments, luckily obtaining two "slivers" which I proceeded to grind down. I succeeded—at least my fingertips made me believe it—and found that the results worked farely well. Hence I argued, that a professional grinder (or petro-microscopist) would succeed, and that a price of, say, $1. to $1.50 would be fair for a small slip, say 1-6 or 1-4 inch square, which size is sufficient. The Tourmalines of microscopical dealers are quoted as high as $8. (See Beck.) Then I bethought myself of a pair of Tourmaline tongs which I had. I cut off one of the fittings, and fitted it in the lower part of a wooden ointment box, wide enough to slip easily over the eye piece.

From what I have observed, I think that the light brown ones are the best, and the slight alteration in the shade of the colors does not make any difference for amusement purposes, and hardly any for scientific investigations. "My" diaphragm is a good idea, the only trouble I have is that the condensing lens is rather unmanageable, as far as accurate focusing is concerned, but my idea can be improved upon. At any rate it gives greatly increased illumination—whether accompanied by the production of false images, is not for me to say—and up to ⅓ objective it is reliable enough.

Models for Constitution and By-Laws of Societies.---V.

CONSTITUTION OF THE OTTUMWA MICROSCOPICAL SOCIETY.

OTTUMWA, IOWA.

ARTICLE I.—NAME AND OBJECT.

This society shall be known as the Ottumwa Microscopical Society. Its object shall be the study of microscopy.

ARTICLE II.—OFFICERS.

The officers of this society shall be two: a President and a Secretary. The secretary shall also be treasurer. The officers shall be elected by ballot at the first regular meeting in September each year and shall hold office for one year or until their successors are elected.

ARTICLE III.—MEMBERSHIP.

The membership of this society shall consist of not more than ten active members and five honorary members. Each member must own or have free use of a microscope with one objective of at least one-sixth inch focus.

ARTICLE IV.—CONDITIONS FOR ADMISSION.

Applicants for membership shall present a written application accompanied by a thesis on some subject of interest to the society at a regular meeting. The application having been read shall be laid over until the next regular meeting when it shall be submitted to a vote of the society. Two members voting "no" shall be sufficient to prevent a person from becoming a member. Should one vote "no" the application shall be laid over until the next regular meeting when a second ballot shall be taken, a full vote of the society being necessary to elect.

ARTICLE V.—MEETINGS.

This society shall meet the second and fourth Tuesday evenings of each month and three members shall constitute a quorum.

ARTICLE VI.—AMENDMENTS.

This constitution may be amended at any regular meeting of the society by a two thirds vote, notice of such amendment being given at the last regular meeting.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Micro-organisms in Water.—This is the title of a volume just published in England at $4.00. The author is Percy Frankland, Ph. D. We have not seen the book, but notices in our European exchanges represent it as a standard work on the identification and removal of low forms of life from water supply. The author gives quite a treatise on bacteriology, including sterilization, media, staining, etc. The action of light upon bacteria is fully treated. In a 126-paged appendix are given descriptions of over 200 micro-organisms liable to be found in water, in the expectation that persons in charge of water supplies will be able to make their own identifications.

Fortunately we have at home an authority upon this subject, Mr. G. W. Rafter of Rochester, who has also published an exhaustive treatise on the same subject.

The duty of $1.00, which it costs to import Dr. Frankland's book is offset by a correspondingly high price put upon Mr. Rafter's book, so that both are out of the reach of common microscopists. Such is the tax put upon science by the monopolist's tariff bill which is now being passed by professed free traders, and by the McKinley law, now in force.

Opium.—Dr. P. Hehir, Surgeon Captain in the Bengal army (and one of our subscribers) has made an extended study of the opium habit. He estimates that there are 1,400,000 consumers in Hyderabad out of a population of 11,000,000. He says that

12 per cent of the Mohammedans, 7 per cent of the Hindus and 5 per cent of the Pariahs use it. Each devotee on the average consumes eight grains per day, four in the morning and four in the evening.

If used in moderation, it enables a person to do more work on less food and sleep than otherwise. For the time being, it gives him unusual cheerfulness and disposition to work, calms irritation, allays excitement, conquers resentment, quiets the nerves and emotions, lengthens life, diminishes the death rate, cures diabetes and never produces organic disease. Its chief evil is producing constipation. Indian opium is pure and contains but little morphine. Life Insurance Companies charge no extra premium on the lives of opium eaters in India.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

194.—*What is a linen-prover?*

It is a small magnifier used for determining the fineness or closeness of weaving in a linen fabric.

195.—*What is a Lucernal Microscope?*

It is a microscope in connection with which a lamp is employed as the source of illumination.

196.—*As a recreation for spare time, would a Swift or Crouch Histological microscope with 1 inch and 1-6 inch objectives at $30, or a Beck's "Star" Microscope with same objective, at $20, be the better? Is a rack and pinion coarse adjustment any great advantage over a sliding tube?—Juvenis.*

A Swift or Crouch Histological microscope should be preferred. A rack and pinion coarse adjustment is a great advantage in *inexpert* hands, and a great convenience in any case. It can be easily and precisely managed with one hand and there is much less danger of forcing the objective against the object. A sliding tube soon gets dirty and works stiffly, or it wears and slides too easily.

197.—*How may I hold sections of rock for grinding between glass plates, with emery, and how shall I separate and clean them?—Nevins.*

Cement the rock slices to the glass with hard balsam, using a gentle heat. After grinding and polishing, remove the balsam by soaking the glass and section in spirits of turpentine. Rock sections are very fragile and in some cases it is better to grind them on the slip which is to be used for the permanent mount, and not remove them, but wash away the debris with turpentine and a brush. When clean add fresh balsam and cover.

198.—*Please give a satisfactory process for separating and cleaning Foramenifera, etc., from chalk?—R. D. Nevins.*

Use a soft brush and water to rub down the chalk. Mix the material with water and allow the shells to fall to the bottom; or, if these heavier portions are broken or not valuable, secure the good portions while still suspended in the water, by pouring them into another vessel and letting them subside. Examine the deposit as well as the floating material at times, with the microscope, to determine their relative values. If the desired shells are rough or covered with granular matter, shake them in a test tube with four times their bulk of well cleaned, heavy, sharp, white sand (prepared by washing and settling as above.) After the shells are clean allow the sand to sink, which it will do before the lighter shells. Pour off the latter into another tube. Here the shells will sink before the lighter fluffy material, and by a careful timing and several repetitions of washings and settlings, the fluff may be poured away, and clean shells secured. But few perfect shells from a considerable mass of material should be expected.

199.—*What is meant by the standard tube length? I read of a ten inch, nine and a quarter, eight and a half and six inch lengths, and so on, and am confused when I wish to use objectives by different makers.* *A reader.*

The standard tube length for American objectives is ten inches, measured from the optical center of objective to the optical center of eye piece. Optical centers are difficult to locate, hence the clear directions by Mr. Spencer, to employ a tube length of 9¼ inches, measured from the shoulder against which the objective rests, to the eye surface of an inch ocular.

The B. & L. Opt. Co. uses a tube length of 8½ inches. their style of eye piece projects ¾ of an inch above the tube, making a total length of 9¼ inches. The objective in both cases completing the 10 inches. The short or continental tube may be measured as above, 6 4-10 inches from eye lens to shoulder for objective. This is the proper length for the usual French and German objective.

200.—*Please cite publications upon our Amœba, since Leidy's "Rhizopoda" was published.* *W. L. Poteat.*

See Am. Mo. Mic. Journal vol. X, pge 151; vol. XII, pge 153, vol. VIII, pge 234 for valuable information on Amœbas.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

How to Examine Pollen.—To see the shape of pollen grains they should be examined without a cover or in a cell as the cover nearly always presses them out of shape and imparts an incorrect idea of their form.

In the common yellow dock, (Rumex crispus), if viewed under a cover, the grains appear round; but, if viewed with an inch objective, they are seen in their natural condition as cubes. An inch objective and a D eye piece is preferable to a quarter inch. The grains are best seen as opaque objects or by oblique illuminations, with a spot lens or a parabaloid.

Staining and Mounting Pollen.—A slide of assorted and stained pollen grains is instructive and attractive. Place the pollen in a small test tube and use any of the aniline dyes used for staining eggs at Easter time. The pollen must be placed into the staining solution while it is hot. It may then be dried on the slide and mounted in balsam. For examining fresh pollen or even for mounting pollen, castor oil is one of the best media. This medium clears the grains beautifully and shows their markings distinctly. The grains may also be stained by aniline colors dissolved in alcohol.

Paste Eels (Anguillulæ aceti).—Paste eels and vinegar eels have been determined to be of the same species but the

paste eels have grown fat by feeding on paste. For an amateur microscopist, the paste eels are preferable as they are larger and more readily examined with low powers. To obtain and keep a supply of paste eels boil a little flower and water to the consistency of the paste used by bookbinders and shoemakers.

It is then best to plant some eels in the paste either by pouring in some vinegar known to contain them or by adding a little paste in which they already swarm. Leave the vessel containing them open to the air and to prevent hardening beat it well together whenever it tends that way. To preserve them all the year, put a little water or vinegar to them if the paste grows dry, or supply other paste. Their continual motion will prevent any mouldiness of the paste. A one inch objective is sufficient to show them nicely.

CORRESPONDENCE.

To Begin With.—Get an instrument by any good maker and by all means let it have a rack-and-pinion coarse adjustment. I have known many to begin without one and never knew one to be contented without it. Get a one inch objective. It is all you want. A 1-6 inch objective would be practically useless to to you. I have given lessons to beginners for years and this is the outcome.—AJAX.

RECENT PUBLICATIONS.

The Journal of Marine Zoology and Microscopy. Vol. 1, No. 1 Nov. 1893.

This is a biological quarterly dealing with the fauna of British seas; and contains many interesting facts and accurate descriptions, in plain wording and accompanied by original illustrations. Personal observations upon the habits of marine animals, together with notes and short articles upon the numberless problems of shore and ocean life, form leading features. The endeavour is to avoid the technical language too frequently met with in Zoological writings, as well as to keep the pages free from trivialities and thread-bare expositions of text book matter.

The Microscopical section consist of "Studies" which deal in pleasant but *exact* manner with the anatomy, life-history and

habits of noteworthy microscopical animals. In this way are treated the Protozoa, the spicular Sponges, the young stages of Zoophytes, Worms, Crustaceans and Ascidians. Thus the studies form a series of most interesting articles of great value, as many of the facts are original, and of a nature not to be met with in ordinary text books.

Two full-page lithographed plates. sketched from life, and of first class execution, are, in each number, devoted to the *original* illustration of the microscopical Marine life treated of in the "Studies." To add to the value of these illustrations, they are often coloured. To ensure accuracy, this is done by hand. There are also reviews, the record of Zoological progress, hints on Microscopical mounting, Exchanges, &c.

The study of the Biology of Ferns by the Collodion Method. By G. F. Atkinson. 8° pp 134, New York, Macmillan & Co. Price $2.25.

To microscopists this book is of more interest than the ordinary treatise upon biology on account of its technique. It is a little unusual to exalt the technique to a mention in the title, but microscopists cannot complain. We can only congratulate the author upon the success obtained by this method as set forth in the book. The infiltration of prothallia without shrinkage was a great success. In Part II, are given methods for preparing collodion solutions, for cultivating spores, for killing, hardening, embedding and cutting into sections the various organs. All this is of great interest to the microscopist. Methods of staining might well have been added, but for some reason do not appear.

Three-fourths of the volume is descriptive of the development and anatomy of certain kinds of ferns and the original illustrations lend much interest to the narative. Chap. I deals with the gametophytes; Chap. II-VI, with the sporophytes. Chap. VII is on "substitutionary growths." A bibliography and an index close the treatise.

We congratulate Professor Atkinson upon having led his pupils through a happy course of study of the ferns and trust that this is not the last we shall hear of his studies in the realm of plant morphology. Let nomenclature go to the rear for a while and let us know all about the processes of vegetable life.

THE MICROSCOPE.

Contents for July, 1894.

Objects Seen Under the Microscope. XIV.—Some New Desmids (Illustrated) 97
The Microscope in the Dairy, by Prof. H. W. Conn 98
How I Got Tourmaline for my Microscope, by Hans M. Wilder 104
Models for Constitution and By-Laws of a Microscopical Society.—V. Constitution of the Ottumwa Microscopical Society 105
EDITORIAL.—Micro-organisms in Water 106
Opium 106
QUESTIONS ANSWERED.—By S. G. Shanks, M. D. 107
194. A Linen-prover 107
195. A Lucernal Microscope 107
196. Swift, Crouch or Beck. Which? 107
197. Grinding Rock Sections 108
198. Separating Foramenifera 108
199. Standard Tube-length 108
200. Publications upon Rhizopoda 109
PRACTICAL SUGGESTIONS.—By L. A. Willson 109
How to Examine Pollen 109
Staining and Mounting Pollen 109
Paste Eels 110
CORRESPONDENCE.—To Begin With 110
RECENT PUBLICATIONS.—The Journal of Marine Zoology and Microscopy 110
Biology of Ferns by the Collodion Method. Atkinson 111

Clark's Practical Methods in Microscopy.

This book is written for beginners and gives in detail descriptions of methods that will lead the novice to successful results. Cloth, 233 pages, 41 cuts and 17 reproductions of photo micrograps, $1.60.

"This is an excellent elementary book, having the rare merit of directness and clearness.—REV. J. D. KING.

"We have had much experience with the perplexities of beginners, and unhesitatingly commend this book to their use as the best book of its kind published."—THE OBSERVER.

Sent by mail postpaid on receipt of price.

D. C. HEATH & CO., Publishers,

Boston. New York. Chicago.

BACK NUMBERS WANTED.

There are several Libraries and subscribers who have written for back numbers of THE MICROSCOPE which are exhausted. For any five of the following, we will give a year's subscription :

1887, Nov., Dec. 1888, Feb., Mar., Apr., May, Dec. 1889, Jan. 1890, Jan., Feb., June. 1891, Jan., July, Aug., Nov. 1892, April.

THE MICROSCOPE.

AUGUST, 1894.

NUMBER 20. NEW SERIES.

Objects Seen Under the Microscope.

XV.—Some Vegetable Sections.

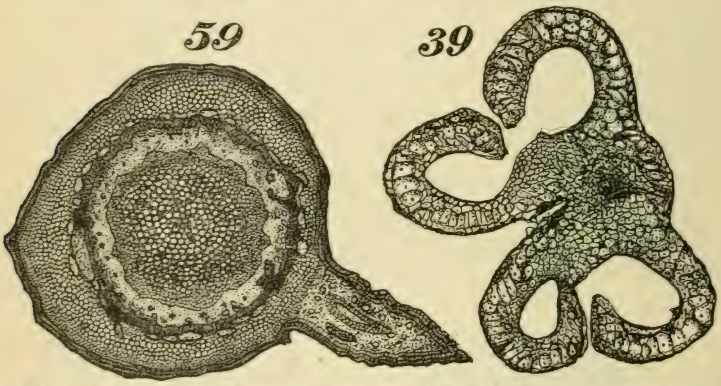
[Pen Drawings.]

In order to give some idea of the botanical sections prepared by Walter White, an English chemist, and for sale by the publisher of this periodical, illustrations of three are given herewith. These sections are cut very thin indeed with a microtome, stained singly, to trebly as the case may demand, mounted on card board by

means of thin slips of mica and sold at the ridiculously low price of 8 cents each or 20 for a dollar. The price gives no adequate idea of their value. They would easily bring 25 cents each in this country if we asked it. But Mr. White cuts enormous numbers and sends them all over the world by mail as an aid to science. It is a

real benefaction to every student of microscopy, as appears from the eagerness with which they have been sought in this country the past six years.

Number 44 is a transverse section of a snowthistle stem and shows the collenchyma. This is a tissue of vegetable cells which are thickened at the angles and usually elongated. It is closely related to parenchyma, but has the cells more elongated. It can be found in the yellow dock and cow parsnip, in the petiole of the summer grape and of the begonia.



Number 59 is a transverse section of the one-year-old stem of Ivy. It shows the resin cells.

Number 39 is a transverse section of the anther of Crown Imperial.

A catalogue of all these objects can be found in the January number of THE MICROSCOPE for 1893, where there are also directions for mounting them upon glass slips when so desired.

Strasburger's Manual of Vegetable Histology, Prof. Bastin's College Botany, Carpenter on the Microscope and Behren's Guide to the Microscope in Botany are good books to use in studying these objects.

To Clean Balsam Mounts.—Use a strong solution of caustic potash. Apply with a brush.

A Quick Method of Cleaning Shells of Bacillariacæ.

By ARTHUR M. EDWARDS, M. D.,
NEWARK, N. J.

Since I first began studying the Bacillariacæ or Diatomaceæ, I have been puzzled to find a process for cleaning their shells in a manner that would be applicable to all the gatherings both recent and fossil. In the recent we have to deal with the organic matter that is present besides the siliceous shells. In the fossil gatherings we have to treat of the siliceous shells hid in a mass of clay more or less hardened. The recent gatherings are easy enough to clean. We burn only the organic matter off and the siliceous shells are left. With the fossil gatherings the case is different and more difficult to handle. The clay present in more or less quantity is not so easily removed. Besides it does not dissolve by ordinary methods. Let us see how we proceed in a quick manner, for I think I have at last hit that to clean the shells.

First, we have a recent gathering consisting of bacillarian shells and organic matter. We pour off the water first, and thus concentrate the shells. Then we pour them into a two ounce, wide-mouthed bottle. Such a bottle I have by me and constantly carry it to make my gatherings in. Into this I put a mass of finely pulverized bichromate of potash—enough, when it is dissolved, to leave some dry. This is enough, for the secret is to have enough. The bichromate is cheap enough, about twenty-five cents an ounce at retail, and an ounce will last for a long time. Now we wait for a few minutes until the bichromate is partially dissolved, and then add enough oil of vitriol (sulphuric acid) to super-saturate the water and cause the evolution of bubbles of carbonic dioxide, commonly known as carbonic acid. The action that goes on developes chromic acid, which is dark red, and this acts upon the organic matter and developes carbon dioxide. This action causes heat to be developed

and it can be carried on in the ordinary flat-mouthed bottle without danger of cracking it.

When it is in action the carbon dioxide is very little and no danger of poison is to be anticipated, for carbon dioxide (carbonic acid) must be in a vast majority in the air to be poisonous, and then its first action is to cause sleep. So, as I have said, there is no danger from poison in the process. While it is hot the bottle is placed out of doors, or at a window, so that the fumes which are going to be made by the addition of another liquid to it and which are poisonous may be carried off and not be inhaled, as that causes coughing. Hydrochloric acid (muratic acid of the shops) is added drop by drop. Immediately a brisk effervescence is developed, and bright red fumes are given off. These fumes are those that cause coughing. Enough hydrochloric acid is added to give off all the fumes, and, though the quantity can not be estimated, it is best to add enough, because the acid is cheap.

The bottle is permitted to stand about fifteen minutes, until the action has ceased, and then fresh filtered water is added in quantity. It is washed in filtered water three times, until it becomes light yellow in color. Then household ammonia is added (I use household ammonia, as it is cheap and strong enough), and it is washed with plenty of filtered water. I always use filtered fresh water for washing bacillarian shells, as I thereby obviate the chances of introducing foreign forms, since these can be introduced very readily, and the gathering is thereby ruined and made useless. This is the entire manner of cleaning recent fresh water shells. They can afterwards be kept in fresh water which has a little true salicylic acid added or oil of cinnamon. This will prevent the appearance of bacilli or of larger fungi.

With salt water recent gatherings of bacillariaceæ, the

process of cleaning is the same as that already described. The salt in the salt water only necessitates the using of a smaller quantity of hydrochloric acid.

When gatherings are made containing fine sand, as is commonly the case, it is rather difficult to concentrate them and separate the bacillarian shells from the sand, and in all cases we must expect to loose some of the bacillariaceæ. But I do not now intend to go into this branch of the subject.

Fossil deposits of bacillariaceæ are always made up of matter which contains clay in more or less quantity, and this modifies the mode of procedure in cleaning them in such a way that the shells may be eliminated, mounted and shown.

To begin with those containing a small amount of clay pulverulent and easily cleaned. The fresh water clay from Bowkerville, N. H., also known as Keene, N. H., is an example. This can be readily cleaned. It is only necessary first to boil it in weak aqua ammonia, add pulverized bichromatic of potash in excess, add oil of vitriol and hydrochloric acid. Clean with filtered water and add weak aqua ammonia and clean in filtered water. Next keep it in water to which salicylic acid or oil of cinnamon is added. In fact such a deposit is cleaned very much in the same manner as recent gatherings, the clay being removed by aqua ammonia, in which it is soluble. Sand is not present so that elutriation is unnecessary.

Next we have to deal with deposits like the fresh water indurated clay found near Virginia City, Nev., and which is known in commerce as electo-silicon. This is more difficult to clean, mainly on account of the large amount of clay present and the indurated character of it. This induration led me, at a former time, to class deposits of this character as volcanic being supposed to be formed in volcanic districts, and therefore as sub-

plutonic. But recent search has revealed these deposits, or some very like them, in districts which are non-volcanic, and they are not always sub-plutonic. But I will not now go into the cleaning of these nor of the marine fossil gatherings, such as those of Richmond, Va., and California, for this paper treats only of the quick method of cleaning the shells. It also records a method of cleaning without the use of nitric acid, which is always troublesome to use, being dangerous also both to the health and the clothes. In the method which I have detailed we have only carbon dioxide given off in small quantity, and the red fumes can be eliminated by the window or out of doors. The process is easy of use and yields very nice preparations.

The Origin of Fresh Water Clays in New Jersey, With Correlation of Clays in Other States.

By ARTHUR M. EDWARDS, M. D.

NEWARK, N. J.

I have been studying the fresh water clays in New Jersey for three years and this is the conclusion that I come to at present.

I have described in the Microscopic Notes nine deposits from the iceberg period, which includes fresh water, fossil, sub-peat and lacustrine sedimentary deposits of bacillariaceæ (diatomaceæ), as they were called when first discovered as lying in the lakes, or former lakes, in this country and Europe. They come from the Third river, or Yantacaw, to the Elizabeth river and neighboring streams in north-eastern New Jersey. The bacillariaceæ, sponge spicules and rhizopoda are the same, and grouped together differently but essentially the same. We have five kettle holes (and kettle holes are depressions of the surface mostly exactly circular without an opening and dry or with water in them), having

the same forms of bacillariaceæ in them. We have three deposits of peat; the forms of bacillariaceæ are immediately between the two, *i. e.*, iceberg period and kettle holes, but mostly resembling the first.

From this I gather that the whole country was covered by a fresh water sea formed by the melting of the ice after the icebergs were gone, and the water was cold. This sea came down from the northeast and threw down the clay which contains the bacillariaceæ, sponges and rhizopoda. Some of these are living now, as at Plainfield, and their decendants are the living forms that now people the brooks, lakes and rivers. And the bacillariaceæ, sponges and rhizopoda now are the decendants of those that lived in the iceberg period. As the water disappeared it left the rivers, the Rahway, Elizabeth, First, Second and Third and their tributaries, all opening into the Passaic river. There were on right bank the Saddle river, and above the Rockaway river on the left bank. I have not thoroughly investigated the Saddle, but think it was formed later than the iceberg period. The Rockaway river was formed in the iceberg period. The Passaic river was formed when the drainage of Lake Passaic, a pre-glacial lake, which in its turn was formed by the ice banking up above Patterson, and below by the mountains of the Watchung, and west the Granite mountains, which form the shores of the lake. This lake when the ice melted broke through the Watchung mountains at Patterson and formed the Great Falls there. The waters which formed it were extended to cover the Great swamp, Black meadows, Troy meadows, Great Peice meadows, and Bog and Fly meadows, and, lastly, Hatfield swamp, which was the last and lowest to form. In the clay of the Hatfield swamp are fresh water and some new marine forms of bacillariaceæ which lived then and are now living as shown by the water supply of Patterson containing them.

The Feldspar, on the northeast, when decomposed formed the clay and was mostly albite or soda feldspar with some orthoclase or potash feldspar, and the sand was quartz sand which is found now in the clay. This clay covered the country from Nova Scotia to the borders of New Jersey on the east of the Appalachian mountains. How far it goes west towards the Rocky mountains has not been determined but it is most likely the same.

The bacillariaceæ, or diatomaceous earths, which are known as fresh water, fossil, sub-peat or lacustrine sedimentary deposits, many of which I examined for the State Geological Survey of New Hampshire, under Prof. Charles H. Hitchcock, and the Northwest Boundary Surver for Mr. George Gibbs, and the State Geological Survey of California, under Prof. J. D. Whitney, are examples. How far to the west of the Appalachian mountains they extend I do not know, but two of them have been sent me by Mr. B. W. Thomas, of Chicago, and both are from the same iceberg period, containing precisely the same bacillariaceæ. These are between the first and second moraines of the western geologists; but we must say that Prof. G. H. Wright has endeavored to prove that there was but one glacial period and the two moraines were but one, formed at different parts of the same glacial period. I am disposed to side with Prof. Wright. The first that Mr. Thomas sent me was from Minnesota and was from Prof. N. H. Winchell, whilst the other was from near Chicago.

Typhoid Fever.

By ELMER LEE, A. M., M. D.
CHICAGO, ILLINOIS.

Recognition of the value of cleanliness represents the most practical discovery in treatment during the present generation, and, at the same time it constitutes one of the

really great discoveries in the history of medicine. The application of the principles of cleanliness more nearly meets the requirements of a real advance in curative medicine, than all the other propositions known to the profession for the cure of disease.

The symptoms of Typhoid Fever are too well-known by all to need particular mention; the question of burning interest is what to do to be saved. The disease is produced by drinking contaminated water, and its seat of development is situated in the intestinal canal. There is a poison there which, if it could be removed before it had become absorbed into the blood, life, and even health would be spared. Allowed to remain, the poison is drawn into the circulation, and very soon the whole body feels the depressing effect. Even at this time, if those remaining poisonous juices and germs which are contained in the bowels were either neutralized by suitable remedies, or washed entirely away by a stream of flowing water, the disease would be checked, the patient spared, and health restored.

Without waiting for development of the symptoms of Typhoid fever the very first proposition is to make the patient surgically clean, which means the free and abundant use of water internally first, and externally afterwards. The bowels are drenched and cleaned by a copious douche of hot soapy water, made to pass into and out of the lower bowel, until the contents are cleared away and the returning water comes back as clear as before it entered. The relief to the sick person by following such ablution is a delight to the physician and of greatest comfort to the patient. It seems so reasonable, they will say, and in practice it is just as good as they say. Fears were formerly entertained by me, as they are to-day by some of my contemporaries, that something would be bursted by running a large volume of water into the bowels of persons sick with Typhoid

fever. No harm has ever been done, and neither is it likely to be so caused. Several hundred cases have been so deluged by me with large quantities of water, and in no instance has the result failed to be beneficial. The fear of doing harm may be entirely and forever dismissed. That which is not well understood by anyone, always seems inconvenient, or troublesome to perform. But a little practice makes easy the methods which a little while before appeared unpleasant, even hard.

The temperature of the water used for cleansing and washing the bowels, should always depend upon the temperature of the body. If there is high fever the water is more agreeable and useful to the patient when it is cool, viz.: 75 degrees; but if the patient is chilly, or has a low temperature, the water should be at blood heat, nearly 100 degrees. During the first week of illness, the irrigation of the bowels should occur in the morning and again in the evening of each day. After this, one douche of water should be given each day until convalescent. The co-operation of the patient is readily accorded. The treatment takes hold of his reason, which lends both hope and help to the management of the case.

Bathing the body is performed at regular intervals and by such a system as may be convenient and suitable to the individual. The bathtub may be used when the patient is strong enough to be assisted to it, where otherwise, sponging with cold water is very refreshing, and useful to maintain strength and lower the heat of the body.

The most effective and most lasting influence is secured by wrapping the patient in a wet sheet. Two blankets are spread on the bed, covered with a sheet wet with cold water. The patient is wrapped in the sheet, and then folded quickly and completely in the blankets. The time during which the sick one may remain in the wet pack is from one half to one hour, or even longer if

he is comfortable. Bathing opens the pores of the skin, and through them the system discharges a part of the hurtful wasts of the body. This bathing should be continued, several times daily, during the disease and during convalescence.

The internal treatment is uncomplicated, safe and useful. The basis of it is cold water, and always plenty of it to drink. Water cools the body and assists to cleanse it of the poison which makes it sick. The elimination is carried on through the intestinal canal, through the kidneys through the lungs and by the skin. Let the sick have water, it can do no harm in any case; water only does good. What cruelty it was in fever cases, to keep water from them, and what suffering it caused. A tablespoonful of Peroxide of Hydrogen (Marchand's) is added to each glass of water. It is the best and most simple remedy that can be given that is likely to be of benefit in helping to cure Typhoid fever. Continued for a few days, it is then laid aside for a few days and Glycozone substituted in its place, both as a relief to the patient and for the beneficial effect of the remedy itself. And so on in this way the two remedies are alternated, which is found by me to be the best arrangement for administering these valuable antiseptics. The preparation, Glycozone, is chemically pure, redistilled Glycerine in which Ozone, or concentrated Oxygen, has been incorporated, and can be taken with as much freedom and safety as pure Glycerine. The Glycozone may be taken in doses of half a tablespoonful to a glass of water as often as water is taken during the day. When it is desired to allay nervousness and induce sleep at night, sulphate of Codeine is used, in doses of from one half to one grain, by the mouth, or one quarter to one half grain by the hypodermic method. This remedy tranquilizes the nervous system and induces sleep, and should be administered at night.

The Typhoid fever patient receives as food, whatever is simple, at regular intervals of four hours. Milk, simple, natural milk, is nourishment of the highest importance. One egg every day, or every other day, is alternated with a small teacup of fresh pressed juice from broiled steak or mutton. The egg is pleasant to take and more nutritious, when whipped till it is light and then stirred with a small glass of milk. For a simple and nourishing artificial food, malted milk is always good.

The juices of fruits are delicious to the Typhoid fever patient, and are not to be dismissed on the supposition that they are injurious. It is always interesting to observe that, when the fever is broken, and convalescence is begining, water in copious draughts is no longer easy for the patient to take. When the usual glass of water is handed back half drained. it is an encouraging sign of beginning restoration. For wholesome drinking, fresh lake water which has passed through a Pasteur porcelain filter is entirely reliable.

The simplicity of the foregoing plan meets every requirement, and saves nearly every case, unless there is some complication. It is my belief that doing more than this is doing less, and less than this which is so simple, is not enough. The profession agrees that no kind of drug treatment is useful or curative in Typhoid fever, indeed, one of these days, in my opinion, the statment will be considered applicable to other, if not all, cases of diseases of the bowels.

The plan as proposed by me and practiced during a period of five years, consists, in review, of the following systematic management in Typhoid fever.

Water used internally as a douche for free irritation of the bowels, either simple or made soapy with pure liquid soap. Water as a drink, and as a remedy taken copiously and frequently, especially during the stage of

fever. Water is indispensable, and should be given as often as is desirable and agreeable to the circumstance of the case. Frequent application of cool water to the surface of the body during the entire illness.

Remedies: Peroxide of Hydrogen (Marchand's), or Glycozone, for the anticeptic effect of the oxygen which is set free in the stomach and intestines. But to be of real value, these remedies are to be taken in considerable quantity largely diluted in water, else, in my opinion, they are of little use. The capacity of the bowels is so great that a little of anything cannot spread over this enormous area to effect it beneficially. Cleanliness is the principle governing the use of Peroxide of Hydrogen (medicinal) and Glycozone.

For a remedy that sooths and brings on sleep at night, sulphate of Codeine is better than chloral, besides it is the safest and best.

For food, anything that is simple and in liquid form. Milk is always the best; milk and whipped eggs; pressed juice from broiled meat. The juice from fresh, ripe fruit. The nutrition taken should be at regular intervals (four hours), that sufficient time may be allowed for digestion.

Stimulants and drugs are injurious without exception, and better results are secured without their use. Typhoid fever, generally transmitted through the drinking water, is a preventable disease. Typhoid fever affects all classes, but if food and water were always pure, no class or age need contract Typhoid fever. Cleanliness everywhere and always is the means at hand which makes it possible to escape Typhoid fever and other diseases of the bowels. Internal cleanliness as well as external is a reasonable proposition of hope for the cure of the unhappy multitude of sick and discouraged humanity.

103 State Street.

NOTE.—The Pasteur system of water purification is suitable and reliable.

The one gallon red rubber fountain syringe, made by the India Rubber Comb Co., has been selected. It is thoroughly good.

Peroxide of Hydrogen (Marchand's) and the Glycozone are standard preparations.

Codeine is generally administered in tablets.

Liquid soap is adapted for medical uses.

Horlick's malted milk is a prepared food of merit.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Communion Cups Spread Disease.—The common goblet is a channel for the transmission of several serious and deadly diseases. The bacteria of tuberculosis, diptheria, and other contagions lodge in the mouth, and are transmitted to the wine by means of epithelium scales which drop from the lips of a communicant into a common goblet at the communion service. These scales float on the surface of the wine, unnoticed, and if a communicant is unfortunate enough to swallow one, the germ may take root in his system.

In passing the cup through the congregation, both the healthy and the unhealthy drink from it. If a communicant should happen to be suffering from any of the diseases that lodge their germs in the mouth, the most liable thing will be to drop the ephithelium scale into the wine, and then pass the goblet to his neighbor, who taking the wine drinks it unexpectingly.

Dr. C. Forbes, an eminent bacteriologist, has done more than any other man in America to bring about a change. He is a member of the Central Presbyterian church of Rochestsr, which was the first congregation in the country to adopt the new pro-

cess. He was also sent by his church to the general assembly of the Presbyterian church in Saratoga to instruct that body about the change and the necessity for making it. There is no doubt that every evangelical church in the land will eventually adopt the method now in vogue in Rochester, Albany, Philadelphia, Boston, and elsewhere. The new process of administering wine is demanded by the highest scientific and sanitary reasons.

After a careful investigation into the dregs of wine left after communion service at several churches in Rochester, a microscope revealed twenty-two living microbs, any one of which could have worked incalculable harm in the system of any person who happened to embibe them. No one can tell the number of germs taken by the communicants on the Sunday that the examination was made, nor the results which will follow. This uncleanly habit of sipping from the same cup has been in practice for so long that in its career it must have caused the death of thousands. However, the practice of partaking of the communion in wine is of such ancient origin, and it is so interwoven in the fibre of religion that it is a difficult matter to make the people see the necessity for adopting the new form. The new communion outfit, which was sanctioned by the general assembly of the Presbyterian church contains sixty small silver chalices about twice the size of a thimble placed in a three tier tray in small rungs. The chalices are protected when filled with wine by dust-protecting covers. The length of the tray is twenty-four inches and it is about five inches broad. A narrow handle reaches across the tray, so that the elders distributing the wine may carry it with ease. In giving the wine each communicant takes a cup and after drinking the wine leaves the cup in the pew. Enough cups are provided for each church so that every member has one.

Celloidin Imbedding.—Drop the scraps of tissue that are to be cut with a microtome into a paper box filled with fluid celloidin where they will naturally sink to the bottom. After the celloidin hardens, tear away the paper box and you have a beautiful block of celloidin. Then place it, bottom side up, in the microtome and the second cut will include sections of the imbedded tissues.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Algæ on a Sidewalk.—Noticing a bright green stain over many of the flagging stones in front of my house, I scraped up a small portion and placed it on a slide. A dissecting 'scope revealed that the material was too full of sand and grit to examine with a larger instrument. I therefore flooded the mass with water and with needles separated from the specimen as much of the sand and grit as possible. With a pair of forceps I then picked up the green mass and passed it through water and then removed it to a clean slide and with the forceps picked out the few particles of sand and grit remaining. I then had a very pretty slide of filamentous algæ. I account for its presence on the flagging by the fact that it is constantly watered with Lake Erie water which is always charged with the spores of the algæ. They may be permanently mounted in a solution of hydrate of chloral and will retain their refreshing green color in that medium.

Seeing Bacillus Tuberculosis with a Low Power.—If properly stained this object can be seen nicely with a one-quarter inch objective. All that an amateur would care to see can be thus exhibited. If stained red on a blue ground it will appear plainly and beautifully.

A Convenient Sub-stage Condenser.—A periscopic eye-piece set in the sub-stage with an adapter will afford a very good sub-stage condenser.

Polarizers are usually fitted with an adapter which may be removed and used with eye-piece in the sub-stage. The condenser certainly improves the performance of the microscope, it renders the light more pleasant to the eye and better defines the objects. Often, things hardly visible without the condenser. for example, bacilli tuberculosis, become distinct when it is employed. With low powers the condenser should be moved down away from the objective and with high powers brought up close to them. No one who has ever used a condenser would be without one. The light is also much improved by using a microscopic lamp with a blue glass inserted in the bull's eye.

THE MICROSCOPE.

SEPTEMBER, 1894.

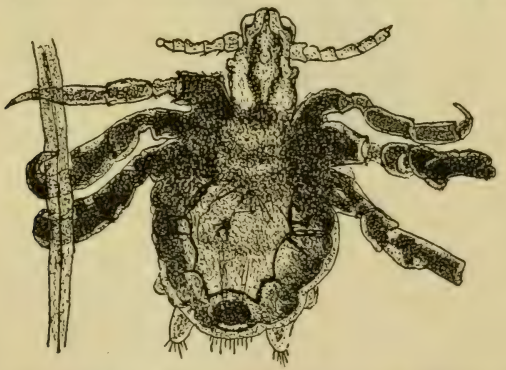
NUMBER 21. NEW SERIES.

Objects Seen Under the Microscope.

XVI.—THE CRAB-LOUSE.

[Pen Drawings.]

In the order Hemiptera, sub-order Parisita and genus Pthirius is to be found the Crab-louse (*Pthirius pubis*). The one shown below has been drawn from a photo-micrograph made by Dr. W. C. Borden, U. S. N., with a Beck one-inch objective. These offensive creatures affect the pubic region and the arm pits of man. They



cling to the skin and make an irritating puncture in the flesh of the unclean persons upon whom they are parisitic.

"There are four prominent processes on each side of the abdomen, beset with long bristles, the posterior pair being the longest and most slender. It is about three-fourths of a line in length, by one-half a line in breadth.

A marked difference from all the other members of this family will be noticed here in the form of the fore-legs. These lack the heavy claws of the other pairs, and have, instead, a slender tapering form with a very slightly curved tarsal nail. The effect is to give them more ready means of moving over flat surfaces, and of turning over if thrown upon the back."—*Riverside Natural History.*

XVII.—Cyst of Trichina Spiralis.

This figure is also drawn from a photograph kindly sent us by Dr. Borden. The trichina is a worm which buries itself in the muscles of hogs, sheep, etc. When

the flesh of an infested animal is eaten, the encysted worm is dissolved out by the gastric juices and then progress is rapid. In a week millions of eggs are produced and soon hatched. The young then penetrate the walls of the intestine and set up a severe irritation throughout the body causing intense suffering. If the patient can get through the few weeks of suffering, the trichinæ will in turn become encysted and cease to do harm.

In 1884, the flesh from one pig killed and eaten in Saxony, Germany was tasted by 361 persons who took the malady and 57 of them died within four weeks.

These outbreaks occur when people eat raw meat. Cooking in the usual manner destroys the vitality of these animals. Hence, never eat sausage, pork, or ham until it has been thoroughly cooked. This whole subject has come to light through the use of the microscope since 1860 when Virchow and others demonstrated the dangers. The trichina was first seen by Hilton in 1835 but its real character remained a mystery until 1860.

On a Plate of Brass for Mounting Microscopic Objects.

By ARTHUR M. EDWARDS, M. D.

NEWARK, N. J.

An observer of nature who does not have the facility of writing down what he thinks he has ascertained is to be pitied. But no two men are constituted the same. What you call facility perhaps another will not call facility and he writes better than you. But I say try to write what you think you see, and we will take it for granted you say what you think. But one who does not possess some knowledge of drawing is of course the man to be most pitied. But knowledge of drawing is rare and comes with inheritance as writing does but more rarely. We can cultivate the knowledge of writing to a certain extent but we cannot cultivate the knowledge of drawing. I remember one man who could write very well but he could not see any perspective and of course could not draw at all. My talent for drawing, of course I can call it with reason so; for talent is inherited. It can be traced to some father or mother, some uncle or aunt easily, and my children will inherit it somewhat. I believe in reversion of talent for it is undoubted, and it can be demonstrated. The facility of putting down on paper by means of writing is also plainly proved. What we are to-day, is an outcome of the piling up of what is

known as atavism or reversion. What we are to-day, is only the consequence of what our forefathers were, because they wrote in a certain manner; as I suppose for instance, I can write in the manner I do. We are creatures of circumstance and the consequence of what our ancestors were. What I do my grandson or nephew will do. For reversion seems to go by the uncle's side instead of the father. Why it is so we cannot of course make out. These thoughts on reversion come up in my mind in consequence of a talent, as I say I may call it, of writing and imitating which I have. I have invented a piece of apparatus for mounting microscopic objects and it is simple and I will describe it.

A piece of brass plate such as printers use,— a brass rule about five to the pica, as it is called, is taken. A piece three inches is cut off. It is one inch wide. To use this in mounting, a slide is laid on it and fastened by an American clothes clip. It has then the object put on it in water and arranged to suit the taste of the mounter or the method of the object. It is then heated with the brass plate down over a small lamp. A gas lamp is best but an alcohol lamp will do. A kerosene lamp will not do as it blackens by soot the brass plate. The heat is dispersed in the slide to the ends, and there is no danger of breaking the slide. When the object is dry, and before it begins to cool, gum or any preservative as Canada balsam, is placed on, and the cover put in place. I find this contrivance obviates the danger of breaking the slides by heat, also it diffuses the heat and keeps them wet with the preservative. I wish it might be tried for I think brass plate for mounting microscopic objects is a great desideratum.

Potassium permanganate is a newly discovered antidote to potassium cyanide. Administer one-half litre of a three to five per cent solution internally.

Immersion Objectives.

By A. C. STOKES, M. D.,
TRENTON, N. J.

From his new book "Microscopical Praxis."

Immersion-objectives are those that require a drop of liquid between the front lens and the cover-glass when in use. Among the advantages obtainable by their employment are increase of working-distance and increase of numerical aperture, with, as a consequence, the admission of more light, and especially the partial, or in some cases, the complete extinguishment of the cover-glass, by which its aberrations are obviated and two reflecting surfaces, those of the cover and of the front lens, are cancelled. The honor of discovering the principle is usually conceded to the renowned Italian professor, G. B. Amici, who exhibited water-immersion objectives at Paris in 1855. It is also said that he used oil as well as water for the immersion-medium, and that he therefore deserves the credit for originating oil-immersion objectives. For the modern homogeneous immersion, however, we are indebted to Mr. J. W. Stevenson, a well-known British microscopist. It was he who suggested to Professor Abbe and to Dr. Zeiss that they should turn their attention to the theoretical and the practical application of the principle; it is to him, therefore, that we owe this great modern advance in practical microscopy.

The use of immersion-objectives is attended by a little more inconvenience than that of dry objectives, and the immersion fluid is likely to be carried over the edge of the cover by the movements of the stage, and so is liable to mingle with the mounting medium in those preparations which are not permanently sealed. This annoyance may be avoided to a great extent by using square covers somewhat larger than the cement ring en-

closing the object, the movements of the stage then bringing the ring indistinctly into view, and the projecting borders of the square protecting both the immersion fluid above it, and the object beneath.

The front lens of these objectives must also be carefully cleaned and dried after the immersion-fluid has been as carefully applied. But the advantages obtainable more than counterbalance the inconveniences.

The fluid is always applied between the lens and the cover-glass. It is difficult to imagine any human being endowed with such unmitigated stupidity, that he should pour the immersion-liquid into the tube of the lens-mounting, yet instances of the kind have been reported.

It is recommended by some that the water, glycerine, oil or other fluid be applied in a small drop to the cover, and the objective racked down until the front lens comes in contact with it. The only advantage of this method, and that advantage is very slight, is that by it the probability of disarranging the object by the pressure of the thick liquid compressed between the cover and the lens, is lessened; and the reader may prefer this method, especially when using glycerine-immersion or homogeneous-immersion objectives, but a great disadvantage is that the moment the objective touches the liquid, the microscopist loses the power to appreciate the distance between the lens and the cover, and is therefore likely to rack down too far and so to do some damage, or not far enough and thus leave too much to be done by the fine-adjustment screw.

When using glycerine or homogeneous-fluid, I am in the habit of applying a drop to the front lens of the objective instead of to the cover-glass. This may be done by means of the cork from the bottle of fluid, a drop being allowed to form at one edge, whence it is carefully placed on the objective without touching the cork to the lens-front; or a rod may be forced through the cork and

the drop adhering to this applied to the lens. One leg of a rubber hair-pin forced through the cork is useful for the purpose, as none of the chemical liquids used for immersion purposes will act on it, as some of them will act on a metal wire. When the drop has been applied to the front of the lens, the objective is attached to the body-tube and racked down until the fluid touches the cover; and as the microscopist looks across the slide, between the cover and the lens, the objective is still further lowered while the lessening distance and the expansion of the fluid are watched, the expansion being continued until the objective is supposed to be approximately focussed, when the fine-adjustment focusses it upward or downward to the proper point. These movements demand exceedingly great deliberation and caution; deliberation so that the object may not be disarranged by the slow expansion of the thick immersion-fluid, if it is not permanently mounted, and caution that the objective be not injured, for immersion lenses are easily disordered. Their lenses are larger than those of smaller angled dry objectives, their construction is more delicate, and they must be treated with more care.

When a water-immersion is to be used, that is, an objective with which water is the immersion liquid, I am accustomed to focus it as a dry objective, as may easily be done, although the definition will probably be abominable and the field dimly lighted, yet enough may be seen to show that the desired object is in view. With a camel's-hair brush a drop of water is then added to the cover near the edge of the objective, under which it will run by capillary attraction. Here all danger of forcing the object out of position or of injuring the objective or the cover, is with ordinary caution, reduced to nothing.

To clean the front of a water-immersion, after using it, the careful employment of the Japanese filter-paper

is all that is needed. To remove the glycerine when used by itself or in combination with a salt, as in the homogeneous-immersion fluids, I am accustomed to wipe away the greater portion with the Japanese paper, and to remove the rest with a few touches of the tongue, finishing with the dry paper.

The cedar-oil used with homogeneous-immersion lenses is thickened with dammar, so that a touch of the moist tongue is likely to cause a deposit of some of the gum on the lens, and to necessitate repeated applications of the paper moistened with alcohol to remove it.* It is better with this liquid to employ the paper alone, and to finish with another piece moistened with alcohol, and to wipe the lens dry and perfectly clean with still another piece.

It is always well to clean an immersion-objective as soon as possible after using it. I have known instances in which the front lens was so insecurely burnished into the metal cell that the fluid has penetrated to the back of the glass, and made necessary a journey to the manufacturer. When the objective is to be out of use for only a short time, it should be placed on the table with the glass surface upward, and when the evening's work is finished, it should be carefully returned to its brass box, after a scrupulously neat cleaning.

When about to measure the angular aperture of an immersion-objective the front must of course be immersed in the proper medium. This may be done by applying a thin cover-glass to the front lens by means of a drop of its special fluid. It is better however, to estimate the numerical aperture by the method already described.

Subscribe for the Microscopical Journal, only $2.00.

* Since this was written I have received from the Bausch & Lomb Optical Company, a supply of cedar-oil not open to this objection.

A Few Hints on the Selection of a Microscope.

By DANIEL E. HAAG, M. D.

TOLEDO, OHIO.

The expert microscopist is able to select for himself, and we venture advice only to the beginner and inexperienced. It is not necessary for the practical, every-day work of the physician that he possess a costly microscope and numerous accessories, but it is desirable to have a good, solid stand, with perfect adjustments, and clear, well-defining objectives.

The first thing, then for consideration in selecting an instrument is the stand. With a good, well made stand free from lateral motion, both coarse and fine adjustments without back-lurch or lost motion, use can be made of such quality of optical parts as requirements may demand or means justify; but with a poor stand the best optical parts will prove an annoyance and a failure. It should possess a good smooth coarse adjustment by means of a rack and pinion, and perfect fine adjustment by micrometer screw; its entire construction should be devised solely for the purpose of using the optical parts to the best advantage. It matters not, and there is no optical advantage in either the long or short tube, provided it has a point for inclination, and the objectives be corrected to correspond with the given length of the tube.

So far as the metal of which the stand is made is concerned, there is no difference whether it be partly of japaned iron or all brass; this can be determined by the amount of money to be expended. While it is advisable to have the stage low, on account of the convenience of manipulation, yet there should be sufficient space for the convenient attachment of sub-stage accessories. As a general rule the American pattern of stands provides more space between the stage and base on the lower side, and stage and tube on the upper side, than foreign stands do.

A movable stage, while not an absolute necessity, neither simply a luxury, is yet a great convenience and a pleasure to work with. For biological work a condenser becomes almost a necessity, and as it must be adjusted for different objectives, the sub-stage must be moveable on the sub-stage bar; a condenser can then be supplied at any future time, without additional expense for after changes in the stand.

The mirror should be double, plain and concave, and swing on the mirror bar and be capable of being brought nearer to or further from the stage.

Two eyepieces should accompany the stand, A and B, or perhaps, C, will usually meet the requirements.

For bacteriological examination a good dry ⅛, or better still a 1–10 or 1–12 inch homogeneous immersion objective will be necessary; but for all ordinary professional use two objectives will answer every purpose for a long time including urinary examinations for the various crystalline deposits, tube casts, blood, pus, etc. A 1 inch of an angular aperture of 25 degrees, and a 1–5 inch of angular aperture of 75 or 80 degrees: or a 2–3 or 3–4 inch objective of 27 degrees of angular aperture, and a 1–6 inch objective of 110 degrees of angular aperture will be amply sufficient. Either the 1–5 or 1–6 objective with the C eyepiece will, with a little eye training, on well stained specimens show the bacilli of tuberculosis. The question is not so much how many diameters will the objective magnify but, what will it show. A well corrected low power objective of wide angle will show more of detail and structure than a poorly corrected and narrow angle high power objective.

It is true that from an optical standpoint objectives give more detail as they increase in their angular aperture yet the highest class of objectives are not always to be preferred. The lenses here advised are not expensive glasses, and yet they will do fine enough work of the

kind for which they are recommended, as a great portion of every-day work, especially of a physician, does not require the maximum of optical performance, and can be as well accomplished, and with less skill of manipulation with glasses of comparatively low aperture.

Such an outfit can be purchased for a sum ranging from $40 to $60, so that the excuse of too great an expense at the start is no longer a good one. But the price alone must not induce one to purchase without any reference to quality. In contemplating the purchase of an instrument we should always be cautious of objectives recommended for their cheapness alone; especially so of objectives not bearing the name of a maker as it is fair to assume that if a maker does not attach his name he knows of their doubtful quality. The inexperienced should always in purchasing, reserve the right of having them examined by an expert. It will require but a short time, in comparing inferior instruments with one of reliable work to discover the inferior quality of the optical parts, and will then not only prove a source of disappointment, but a pecuniary loss as well as it will necessitate a future outlay for reliable work, or may lead to discouragementand abandonment of a fascinating and practically useful study.—*Toledo Medical Compend.*

THE THERAPEUTICS OF GLYCOZONE, COMPOSITION AND CHARACTERISTICS.

By Cyrus Edson, M. D.

Health Commissioner, Board of Health, New York City.

Glycozone is defined by its discoverer, Mr. Ch. Marchand, to be a stable compound, resulting from the chemical reaction that takes place when c. p. glycerine is submitted, under certain conditions, to the action of fifteen times its own volume of ozone, under normal atmospheric pressure at a temperature of 0°C.

The necessity of using c. p. glycerine is imperative, as a presence of the water or other foreign matter in the glycerine causes the production in the resulting compound of formic acid, glyceric acid, and other secondary products, that have a harmful effect upon animal tissues.

Glycozone has a pleasant, sweetish taste. Being hydroscopic it must be kept in tightly corked bottles, and, as long as it is kept in this condition, it does not deteriorate at a temperature of even 110 degrees F.

Antagonists and Incompatibles.—Glycozone, like peroxide of hydrogen is a powerful oxidizing agent, although its action is not as rapid or as energetic in this respect as the latter compound. Consequently, we cannot safely prescribe it combined with any other drugs or chemical substances. Contact with metalic utensils decompose it. We must therefore use glass or hard rubber vessels and syringes when administering it.

Physiological Action.—When taken into the mouth and stomach glycozone causes a feeling of warmth. It excites a flow of saliva and stimulates the gastric secretions. Being hydroscopic it attracts to itself water from the surrounding tissues but not with sufficient power to effect harm. This property is due solely to the glycerine base which enters into the composition. In very large doses, one or two ounces, it causes a feeling of distress in the epigastrium and is followed by loose, copious, watery stools, which are accompanied by severe cramps.

No effect is noted on the kidneys, the liver or the heart. Glycozone is undoubtedly slowly decomposed in the stomach, ozone being liberated and the glycerine uniting with the water from the tissues. The morbid elements with which it comes in contact probably hasten this decomposition, and in so doing are themselves oxidized and destroyed. The free ozone in the stomach resulting from the decomposition of glycozone aids the digestive process by its presence.

Therapy.—Glycozone is, in the opinion of the writer, the best known agent for the treatment of gastric ulcer. It is also one of the best remedies for the treatment of the stomach, catarrh of chronic alcoholism, and for chronic gastric catarrh from other causes. It is excellent for atonic dyspepsia, and for acid dyspepsia. The writer has seen very gratifying results from its use in these distressing maladies.

In catarrhal and other stomachic diseases except gastric ulcer, the remedy is best administered in one or two teaspoonfuls in a wine-glassful of water immediately after meals. In the case of gastric ulcer the dose and dilution should be the same, but it is better to give it when the stomach is empty.

Glycozone has an excellent effect when used internally in cases of diphtheria. For this purpose a tablespoonful of glycozone is given in a wineglassful of water every three hours. As it is perfectly harmless it may be used without apprehension. The following treatment is excellent in cases of membranous croup: The nose, throat, mouth, pharynx and larynx should be sprayed copiously every two hours or so with a mixture of one ounce of Marchand's peroxide of hydrogen (medicinal), with four to six ounces of water.

The membranes are readily destroyed, and by using this remedy freely, their reproduction is prevented. Then one teaspoonful of glycozone, diluted in a wineglassful of water, administered three times a day, prevents any disturbance of the stomach and regulates the bowels.

Remarkable benefit may be derived in the treatment of diseased conditions (ulceration and chronic inflammation) of the rectum and lower gut, by enemata containing glycozone and for this purpose nothing excels the following formula:

Glycozone, 1 ounce.

Water, lukewarm, 12 ounces.

This should be mixed immediately before using and administered with a hard rubber syringe once daily. It is frequently desirable to use a smaller amount than the above mixture. The proportions 1 to 12, however should be maintained. In cases of fistula-in-ano and of rectal ulcerations low down, an ounce of lukewarm water containing a drachm of glycozone administered once or twice daily soon effects good and in cases of ulcer, pure and simple, may be expected to radically cure the diseased conditions.

External Uses.—After the cleansing of any diseased or suppurating surface by peroxide of hydrogen (medicinal), the application of glycozone stimulates healthly action and hastens the cure. For this purpose it has no superior in the entire range of therapeutics. It tends to check the discharge of irritating unwholesome secretions and to prevent the infection of

the sore by pathogenic organisms. Its action in this respect is explained by the fact that it is both powerfully antiseptic and stimulant.

Follicular Pharyngitis, chronic coryza and ulcerative stomatitis are all benefitted by frequent applications of glycozone. As an application to ulcerated cervix-uteri and in tumefied conditions of the cervix and uterus it is far superior to pure glycerine.

In these cases, and for the cure of leucorrhœa, the remedy should be applied on small rolls of lint, or absorbent cotton, the vagina having first been thoroughly washed with an injection of peroxide of hydrogen one part, water four parts. This procedure should be repeated twice daily.—*Times and Register.*

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Microscope for Recreation.—The most important point in Dr. Dallinger's second lecture on The " Modern Microscope " at the Royal Institution was its use as an instrument for intellectual recreation. He pointed out that the vast strides made of late years in the construction of the instrument has greatly altered its fitness for use in the hands of the amateur. It was true that now as in the past to utilise the microscope in its highest powers, long training and specialised knowledge were requisite, which fact narrowed its area for recreative use. But this was true of all instruments of precision, and yet there existed no scientific instrument which, thanks to modern devel-

opment, left a broader area for the intelligent amateur who was willing to devote some little time to acquiring the necessary manipulative skill. The necessity for this latter accomplishment was greater with the modern instrument, not because its wonderful modern perfections had introduced complexity—on the contrary, they had simplified it—but, being the outcome and embodiment of mathematical certainty, it was only by using it on scientific principles—easily learned—that the finest results could be obtained. Dr. Dallinger is an expert of experts in the use of the microscope; but if he appears at times to talk above the heads of the general run of users of the microscope, he is only encouraging them to work away at a study which becomes more fascinating as the student progresses. In the course of his lecture he showed what could be done by the use of moderate powers in the hands of an intelligent novice, and it should be remembered that even experts have been novices once.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Mounting of Small Insects.—Most small insects may be mounted by soaking them in oil of cloves, then in turpentine and then placing them permanently in balsam. They should be permitted to soak in the oil of cloves and turpentine until they are perfectly transparent. The slightest moisture will cause a black discoloration when the object is placed in balsam. The method here indicated is suitable for soft insects such as fleas, green bugs, etc., but will not answer for the coleoptera or hard-shelled varieties. The latter should be immersed for a time in potassium hydrate before being placed in the oil of cloves or turpentine.

Microscopical Apparatus.—While shifts and expedients are proper for one who can afford nothing better, long experience will convince one that the microscope and its primary accessories can be purchased more cheaply and will be more satisfactory than any thing an amateur can devise. The makers are in the business; they possess the skill and have all the dies, instruments and machinery necessary to the produc-

tion of perfect work. The mere amateur or the one not equipped for the purpose can hardly hope or expect to equal the expert manufacturer. Imperfect machinery will always produce imperfect work. So while one may succeed in minor details, unless the main machinery is perfect the whole result will be wrong. It is also well that an amateur should purchase a few type slides from a dealer. The beauty and completeness of such slides will be guide posts along his line of progress. No one can discover everything and it is but the aggregation of ideas that constitutes our progress and our civilization.

Sections of Tapeworm.—Nature has divided tapeworms into sections. To mount a section it should be soaked in hydrate of potash, then washed and cleansed in water and then stained with carmine, hæmatoxylin or some other suitable stain. But the amateur should be very careful in handling these sections, for each section, below the head, contains myriads of eggs and one minute egg from the finger to the mouth, would pass to the stomach, then into the circulation, and finally to the brain where convulsions and death are caused. It is a good object for amateurs to let alone. Students in this department are especially liable to danger.

Æcidia or Cluster Cups.—These are beautiful objects for low powers of the microscope. They are found in leaves in the spring. They were formerly supposed to be distinct species and are still classified as such in foreign works. They are now known to constitute the initial stage of higher fungi. A section of a leaf with a cluster cup is an instructive object for a quarter inch objective. See Bessy's Botany, page 311 and see M. C. Cooke, Microscopic Fungi, Chap. 1.

Celloidin Imbedding.—Drop the scraps of tissue that are to be cut with a microtome into a paper box filled with fluid celloidin where they will naturally sink to the bottom. After the celloidin hardens, tear away the paper box and you have a beautiful block of celloidin. Then place it, bottom side up, in the microtome and the second cut will include sections of the imbedded tissues.

To Clean Balsam Mounts.—Use a strong solution of caustic potash. Apply with a brush.

THE MICROSCOPE.

OCTOBER, 1894.

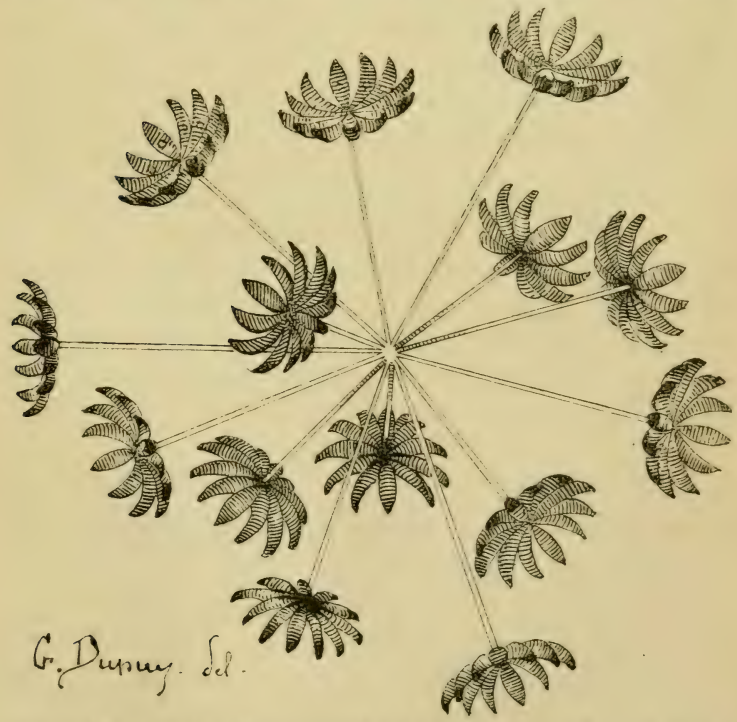
NUMBER 22. NEW SERIES.

Objects Seen Under the Microscope.

XVIII.—A NEW DICTYOSPHÆRIUM.

[Pen Drawings.]

Through the kindness of Mr. Thomas Craig, we are able to present the accompanying illustration. It is a



view of a newly discovered plant. It was found along

with other algæ, tangled in the roots of water cress in a pond on Staten Island (back of the Moravian cemetery). The beauty and regularity of outline of this plant is remarkable. The drawing was made by Mr. G. Dupuy. In size the plant is only about 5 mm. in diameter or smaller than the head of one of the smallest of pins.

The plant is enclosed in a globular envelope of transparent jelly, the outside of which is of a slight yellow tint, caused presumably by age or some staining material in the water. From a point in the centre of the globular mass sixteen faint silvery-like filaments radiate to near the circumference, where each filament is crowned with a cluster of twelve to fourteen fusiform, curved, bright green cells, each attached to the filament by one end. The cells, in length, are about five times the width. The cells are filled with a green material slightly granular and much condensed at the outer end. A well defined and large nucleus occupies the centre of each cell. The part of the cell nearest the filament is only faintly green.

In Wolle's description of this genus he describes the cells as green, and egg or kidney shaped, united in a globose hollow family, involved in a gelatinous integument. He describes four species: *D. pulchellum*, Wood, *D. reniforme*, Bulnh, and *D. Hitchcockii*, Wolle. The one under consideration does not agree in description with any of the above species.

A Note, Incidentally in Regard to the Animality of the Diatom, but Especially to Mr. Cunningham's Method of Illumination.

By DR. ALFRED C. STOKES.

TRENTON, N. J.

In reference to Mr. Cunningham's contention that the diatom is an animal I have nothing to say, except that I do not believe it; and in regard to his claim that he has

proved that animality, I do not hesitate to say that in my opinion he has done nothing of the kind. He entitles his paper "The Diatom Considered as a Protozoan, with Method of Demonstration," and says, on page 231 of the Microscopical Journal for August last, that if certain events had not occurred "I would have had to continue in the mental attitude of one who strongly suspects the animal character of the motile diatoms, but cannot crystallize his proof into a concrete expression for lack of demonstrable evidence. But this stage has been safely passed and an easy method of verification is accessible to all who use the microscope as an instrument of research, or for biological studies of any kind." If this and his title mean what they seem to say, then Mr. Cunningham asserts that he has proved the diatom to be an animal, and that any one accustomed to the use of the microscope can repeat that proof. Mr. Cunningham deserves credit for the courage that supports him in the publishing of these convictions.

But personally, I should have read his interesting article with more confidence, if he had not been so careful to explain his method of illuminating the instrument and of using the condenser. His explanations of these points vitiate his entire paper, and render almost worthless what otherwise might have merited some consideration.

For the elucidation, and especially for the teaching of such fine points as Mr. Cunningham has undertaken to demonstrate, nothing short of what is called critical illumination and the production of the critical image, should have received his earliest attention. On the contrary, by his own showing, he has examined his specimens in what is describable only as an optical mess; he then says that he has proved the animality of the diatom, and seems to expect the readers of this Journal to accept his teaching in opposition to what has stood the test, and been universally received, for years.

He says (page 234): "In regard to the lighting, and some other requisites of illumination, an Argand burner lamp is used, a bull's-eye condenser being adjusted as near as possible to the flame, and a large image of the flame projected so as to fall on the concave face of the mirror." He not only uses a convex flame-surface, but he endeavors to condense the light on the concave mirror, when the source of that light is not in the focus of the bull's-eye, since he puts the bull's-eye "as near as possible to the flame." This might not be so bad, but "To the sub-stage," he continues, "an achromatic condenser is adapted, and when the light is properly centered in the field, the result will be a dazzling light. But in order to guarantee the successful view of the various phenomena, it is necessary to have at hand a glass slip, or a smaller piece of emerald or grass-green colored glass (blue will not answer). This slip must be placed on top of the condenser, or the slide containing the living diatoms must rest directly upon the green glass slip."

If this again means what it says, then Mr. Cunningham uses the concave mirror with the achromatic condenser, having the bull's-eye placed between the mirror and the light but not focussed, and the condenser itself out of focus, whether within or without it is hardly possible to guess, but probably without; and to "make confusion worse confounded," he inverts a small-angled, half-inch objective and uses it as an eye-piece. When these things have been accomplished, Mr. Cunningham gravely describes his observations, and not only expects the general reader of this Journal to treat his paper as something more than an "American joke," but he seems to want expert microscopists and biologists, learned diatomists and naturalists, to accept the statement that he has proved the motile diatoms to be animals, and proved it by the optical methods, or rather by the absence of optical methods, which he so explicitly details.

If I use pungent English in thus expressing my personal opinion, it is not that I have any unfriendly feeling toward Mr. Cunningham, for whom I have nothing but respect, and the greatest commiseration in the formidable task that he has set for himself; it is not because I think him wrong in his conclusions; nor that I am anxious to appear in print with harsh criticism, as I am not, for I have asked the editor to destroy my manuscript if any other person has enough interest in the subject to call attention to Mr. Cunningham's reprehensible method of illumination, especially reprehensible when he is laboring to overthrow the accepted teaching of the most learned specialists. He may have proved what he claims. I do not think he has; but aside from this part of the subject, the methods of illumination by which he arrived at his conclusions are open to the gravest criticism, and the results obtained in such circumstances, always remembering Mr. Cunningham's purpose, are to be considered, even slightly, only after he has corrected what must have been an oversight, an omission made when his thoughts were busy with an observation that might be a startling discovery, and result in the transferring of a great group from one natural kingdom to another. Microscopical objects used as a basis for assertions as important as Mr. Cunningham's would be if they were proved, demand, in these days, not only the most careful illumination with the best optical appliances, but the results must be almost worthless unless the observations are made with wide-angled, oil-immersion objectives, with an achromatic condenser having a numerical aperture approximating that of the objective used, and perhaps with compensating eye-pieces, certainly not with an old-fashioned, half-inch objective reversed and employed as an ocular. And why Mr. Cunningham shoulp use grass-green glass and condemn blue glass which, when of the proper shade, is commended by microscopists the world over, I do not comprehend.

The Oldest Fossils, Microscopic.

BY ARTHUR M. EDWARDS, M. D.
NEWARK, N. J.

About two years since, Dr. Chartes Barrois announced in a brief note to the "Comptes Rendus," the discovery of Radiolaria in the Pre-Cambrian rocks of the horizon of the mineral schists and phyllites of St. Lo, in the north of Brittany, France. The further description of these, probably the oldest fossils known, older than the Eozoon Canadense, was intrusted to M. E. Cayeux, who had considerable experience in the study of Radiolaria and other microscopic organisms in the Cretaceous works; and the first announcement has just come to me from M. Cayeux.

There can be no doubt with respect to the Pre-Cambrian rocks in the section where the Radiolaria were found. There are bands of phthalate from half an inch to over three feet in thickness, interstratified with schists. The phthalate are principally crystalline silico and a certain amount of carbonaceous material is also present in them. The presence of Radiolaria shows that the carbonaceous material is organic matter like the carbonaceous material in the Laurentian rock where the Eozoon is found. The Radiolaria is distributed in the phthalate irregularily, sometimes occurring singly, at others in great numbers closely associated together, so as occassionally to be in actual contact. They are exceedingly small in size—.001 mm. to .022 mm. in diameter—and to observe their structures it is needful to use much higher objectives than those required for other fossils and for recent Radiolaria.

By far the larger number are spherical in form; some are elipsoidal, and there are many varieties of the inflated or cyrtoidal bell-shaped forms. One or more radial spines occur in several forms and in two or three, an inner concentric shell connected by rays with the

outer test has been detected. Most of the forms figured have holes or perforations in the outer test, thus showing a lattice-like structure.

M. Cayeux has figured 45 different forms assigned to 19 genera of Radiolaria. The figures are drawn by an artist totally unacquainted with those organisms and therefore unbiassed. They present strong prima facie resemblance to known Radiolaria. The small size of the Pre-Cambrian bodies compared with undoubted recent Radiolaria is marked but is of course accounted for. Dr. Rust who examined the Pre-Cambrian bodies thinks some of them move like Foramenifera than Radiolaria. That they are organic forms there is no doubt.

In the words of G. J. Hinde, "the importance determining the real character of the minute bodies in these Pre-Cambrian rocks will be generally recognized and we trust the author will persevere in his researches until he meets with evidence sufficient to convince those who now feel some hesitation in accepting his conclusions about them."

Walker Prizes in Natural History.

By SAMUEL HENSHAW, SECRETARY.

Boston Society of Natural History, Boston, Mass.

By the provision of the will of the late Dr. William Johnson Walker two prizes are annually offered by the Boston Society of Natural History for the best memoirs written in the English language on subjects proposed by a committee appointed by the Council.

For the best memoir presented a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the committee.

For the next best memoir, a prize not exceeding fifty dollars may be awarded.

Prizes will not be awarded unless the memoirs presented are of adequate merit.

The competition for these prizes is not restricted, but open to all.

Each memoir must be accompanied by a sealed envelope enclosing the author's name and superscribed with a motto corresponding to one borne by the manuscript, and must be in the hands of the Secretary on or before April 1st of the year for which the prize is offered.

Subjects for 1895 :—

(1) A study of the "Fall line" in New Jersey.

(2) A study of the Devonian formation of the Ohio basin.

(3) Relations of the order Plantaginaceae.

(4) Experimental investigations in morphology or embryology.

Subjects for 1896 :—

(1) A study of the area of schistose or foliated rocks in the eastern United States.

(2) A study of the development of river valleys in some considerable area or folded or faulted Appalachian structure in Pennsylvania, Virginia, or Tennesee.

(3) An experimental study of the effects of close-fertilization in the case of some plant of short cycle.

(4) Contributions to our knowledge of the general morphology or the general physiology of any animal except man.

NOTE.—In all cases the memoirs are to be based on a considerable body of original work, as well as on a general review of the literature of the subject.

To Prevent Vegetable Sections Turning Dark.—Soak in alcohol to which 2 per cent of hydrochloric acid has been added and let them dry slowly.

Bleaching Leaves.—Chlorinated soda is the best fluid for bleaching vegetable specimens.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Stokes vs. Cunningham.—In order to excite interest and make matters lively, we publish in this number an article by Dr. Stokes, the former editor of this periodical, attacking quite vigorously a recent article by Mr. Cunningham the well known expert in diatoms. Although there have elapsed two months since the publication of Mr. Cunningham's paper, no one but Dr. Stokes has written us attacking it, and the latter's request to destroy his manuscript in case some other correspondent should notice the matter has been respected. Mr. Cunningham, strange as it may seem, has requested its publication; and will, it is presumed, defend himself in due time. Lively times are ahead or else a graceful retreat for somebody. We shall see who will play the General McClellan in this case. By the way, was not McClellan a New Jerseyite?

More Booes.—A new Handbook of Medical Microscopy, this time by James E. Reeves, M. D., is announced. It seems as though Wethered's ought to have been sufficient for the present, but when we see Reeves' we may feel differently. Dr. Reeves has practiced medicine forty years and has doubtless tested most of what he writes about.

Sand Grains.—A Mr. Watt, of 144 High street, Elgin, Scotland, has published a little pamphlet on sand grains, explaining the utility of the microscope in examining the constituents of rocks, etc. We should like to see a copy.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

202. *Who are the best authors on histology and urinary analysis?—Hardy.*

Tyson, Examination of Urine, cost $1 50.

Hofmann and Uitzmann, Analysis of Urine, cost $2.00.

Klein, Elements of Histology, cost $1.75

Stirling, Practical Histology, cost $3.00.

All are good works on their subjects.

203. *Is the "Wenham" stand described in Hogg's "The Microscope," now on sale? Is it not a very good one?—R. Rich.*

The stand figured in Hogg, was intended to illustrate a binocular stand furnished with a Wenham prism; the Wenham prism is the one commonly used in binocular stands and is a very good one.

204. *Who now sells the Bullock stands?—R. Rich.*

E. B. Meyrowitz, 104 E. 23rd St., New York.

205. *What is a "Spot Lens"?—S.*

Carpenter says a spot lens is a condenser with a permanent axial stop fixed in it to cut off the central rays for the purpose of obtaining a dark ground upon which the illuminated object lies. Obviously it is not a desirable accessory. It is a condenser, but having a fixed stop it can only be used for this mode of illumination.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

A Double Nose-Piece.—The part of a double nose-piece supporting the unused objective should stand perpendicularly out from the tube of the microscope. If allowed to be on one side it will prevent the proper revolution of the objectives and will subject them to great danger. No accessory can afford more comfort, save more time or wear and tear than a nose-piece.

Leaves of Deutzia.—Elaborate directions are often given for the preparation of slides of Deutzia leaves. Nothing can excel a slide made by simply pressing and drying the leaves and mounting them as opaque objects.

The number of points to the stars vary on the different sides of the leaf. The stars polarize nicely, but as a polarizing objects should be prepared by removing the cuticle and mounting it with the stars as a transparent object.

A Dissecting Microscope.—For good work in mounting, a dissecting microscope is an almost indispensable accessory. Fine instruments of this kind are supplied by dealers. The beginner, with the exercise of a little ingenuity, can improvise a serviceable instrument for the purpose. The essentials are a stage to work on, a simple lens held by a pillar, and a mirror to cast light upon the object.

The lens should be adjustable for focus. A reading glass or a set of cheap lenses will do the work. Much magnification is not proper or requisite. The same thing may be accomplished with a pair of watch-maker's glasses fixed to the eyes while dissecting. Without some sort of arrangement, preparations will be clumsy and the most beautiful and instructive parts of a specimen will generally be obscured or neglected.

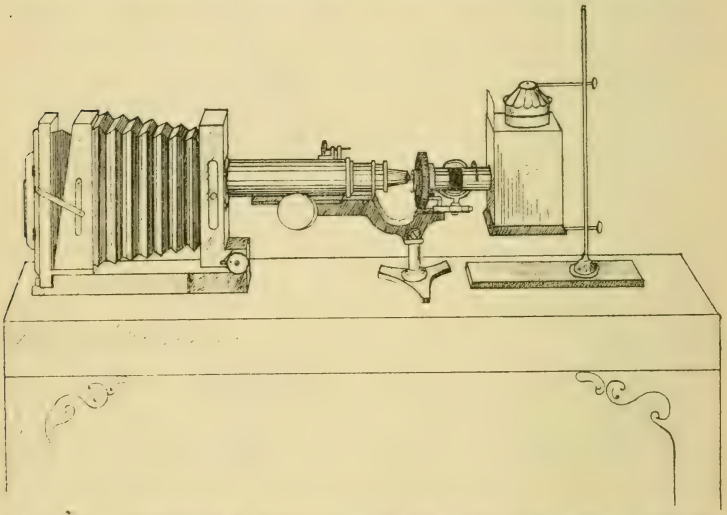
Leaf Fungi.—The simplest and probably the best way to keep leaf fungi for the microscope is to dry and press the leaves, with the fungus, and then wrap the specimens in papers, recording on the paper the name of the specimen, the locality where found, and the kind of leaf on which the specimen is growing. The leaves can be used as opaque objects and will exhibit the fungus in a natural condition; by removing a few spores with a spatula, placing them in a drop of water and examining them with a quarter-inch objective they will appear to the best advantage. Mounting is apt to shrivel and distort the spores and give but a faint idea of the natural object.

Dark Ground Illumination.—This may be produced without any accessory by simple using oblique light upon a transparent object. Set the microscope sidewise upon the table, turn the mirror obliquely and set the lamp so that the rays of light will strike the concave mirror. Butterfly scales, pollen, a living cyclops and thousands of other objects are beautiful

when examined in this manner. When properly done, the effect is equal to a spot lens or a parabaloid.

CORRESPONDENCE.

Dr. Shufeldt's Improvised Apparatus for Making Micro-Photographs of the Parasites of Birds.—Every one of us who have collected birds have often noticed that if the specimens are set aside for a few hours, and the bodies become cold, numerous little parasites which have infested them during life now crawl out upon the ends of the feathers or bristles around the base of the mandibles. Here they will often remain until they starve to death and fall off, or disappear in other ways.



Hundreds of times I have looked at them with a high-power hand-lens with great interest, but never made any sketches of them, as I had at that time devised no means to do so with accuracy. Later, I was again attracted to the subject, but owned no micro-photographing instrument of any kind. But a day or so ago I determined to overcome this most serious difficulty and improvise a micro-photographing apparatus of some form or other, and in the venture I succeeded far beyond my most sanguine expectations.

This is the way I did it, and my sketch of the affair as finally

set up will help my readers to comprehend my remarks about it. These I will give in some little detail as I hope to have others investigate and describe some of the parasites of our birds. Most naturalists nowadays own a camera and outfit, and also a microscope and its outfit. This is my case. In the first place, then, I took my largest camera and placed it on a long table as shown in the sketch. I removed its lens and lens-boards, and fitted a cardboard front to take its place. Next I took my largest microscope—a Beck's Monocular National—and brought it into the horizontal position. I fitted the upper end of its body, while in this position, into the cardboard front of the camera. A substage condenser, and a three-fourth inch objective were next attached to the microscope, and the camera and the latter coupled together. Now most micro-photographers omit using the eye-piece of the microscope, but with it I subsequently obtained the best results. It is inserted *after* the barrel or body of the microscope is run through the cardboard into the front part of the camera-box.

For an illuminator I used the dark-lantern of my photographic outfit—simply withdrawing the ruby-glass slide in front, and fitting in its place a thick piece of cardboard, into the center of which I inserted the lens from a small camera to act as a "bull's-eye condenser." This is coupled with the substage condenser on the microscope by means of a broad rubber band. My lantern I held nicely in the proper position by suspending it between the "rings" of a chemical standard, as shown in my sketch; but any simple device will hold your lantern up in its proper place. It can even be "built up" by putting books under it. Both the lantern and microscope rest upon a very thin board which travels with ease on the extension-bed of the camera-box. By this latter simple contrivance, focussing your specimen on the ground-glass of the camera is easily managed. The screws control the whole thing, and the rest can be with ease understood from my sketch of the plan adopted.—*Auk.*

SCIENCE-GOSSIP.

Hydrogen Dioxide.—This remarkable liquid which contains the greatest percentage of oxygen of any compound known, was, for sometime, considered as a mere solution of oxygen in water, and consequently was called oxygenated water. It was

afterward obtained free from water and found to be a definite chemical compound of hydrogen and oxygen, and differing from water in containing twice as much oxygen. In this state it is a heavy, oily liquid, readily decomposed at ordinary temperatures but if heated, with explosive violence, being converted into ordinary water and oxygen gas. When poured into water it sinks, being nearly half again as heavy as that liquid, but is miscible in all proportions with it. It has a somewhat bitter, astringent taste, and is colorless, transparent and without odor. It bleaches the skin, hair, ivory and destroys organic coloring matter, pus and all organisms with which it comes in contact by liberating oxygen gas in a nascent or active state.

The preparations found in commerce are only solutions of this compound in water, and sold in different degrees of concentration or strength, rated by the number of volumes of oxygen gas they can be made to yield. A fifteen volume solution is one that will give off fifteen volumes of gas from one volume of the solution. A ten volume solution will yield ten pints of oxygen gas from one pint of the solution, and so on.

These solutions, although more stable than mere concentrated preparations, nevertheless decompose and lose their nascent oxygen on which its powerful antiseptic powers depend, and consequently we find the commercial brands varying considerably from their reputed strengths. The solution containing the greatest percentage of available oxygen is the preparation known as Marchand's, which, when perfectly fresh, is about a fifteen volume solution.

RECENT PUBLICATIONS.

The study of the Biology of Ferns by the Collodion Method. By G. F. Atkinson. 8° pp 134, New York, Macmillan & Co, Price $2.25.

To microscopists this book is of more interest than the ordinary treatise upon biology on account of its technique. It is especially to be recommended to microscopists because the author is in thorough sympathy with us in all of our purposes.

He is a teacher and a skilled microscopist, in every manner qualified to write on such a topic. His book contains a record of his own work and discoveries.

THE MICROSCOPICAL JOURNAL.

Contents for October, 1894.

On the Limitation of Tuberculosis, by Dr. W. W. Alleger 289
On Species in the Desmidiæ, by Arthur M. Edwards, M. D. 299
A Study of the Microscopic Phenomena of Commencing Inflammation, With Special Reference to the Diapedesis of the White Blood Corpuscles, by Chas. F. Craig, M. D. 301
Microscopical Technique Applied to Histology.—VII 314
The Character and Uses of Glycozone, by Cyrus Edson, M. D. 318
EDITORIAL.—The Practical Value of the Microscope 320
MICROSCOPICAL APPARATUS.—Construction of Microscope Stands. 320
MICROSCOPICAL MANIPULATION—Simplification of Laboratory Methods 321
MEDICAL MICROSCOPY.—A Study of Palsy 322
BIOLOGICAL NOTES.—The Smallest Known Flowering Plant 322
MICROSCOPICAL SOCIETIES.—Lincoln Microscope Club, Roscoe Pound, Secretary. 323
MICROSCOPICAL NOTES.—Microscopical Praxis 324
Inoculation of Warts 324
Primary Dissecting Microscope 324

THE MICROSCOPE.

Contents for October, 1894.

Objects Seen Under the Microscope. XVIII.—A new Dictiosphærium (Illustrated) 145
A Note, Incidentally in regard to the Animality of the Diatom, but especially to Mr. Cunningham's Method of Illumination by A. C. Stokes, M. D. 146
The Oldest Fossils, Microscopic by A. M. Edwards, M. D. 150
Walker Prizes in Natural History 151
EDITORIAL.—Stokes vs. Cunningham 153
More Books 153
Sand Grains 153
QUESTIONS ANSWERED.—202. Writers on Histology and Urine 154
203.—The Wenham Microscope Stand 154
204.—The Bullock Microscope Stand 154
205.—A Spot Lens 154
PRACTICAL SUGGESTIONS.—By L. A. Willson 154
A Double Nose-piece 154
Leaves of Deutzia 155
A Dissecting Microscope 155
Leaf Fungi 155
Dark Ground Illumination 155
SCIENCE-GOSSIP.—Shufeldt's Apparatus for Photo-Micrography 156
Hydrogen Dioxide 157
RECENT PUBLICATIONS. 158
Biology of Ferns—Atkinson 158

THE MICROSCOPICAL JOURNAL.

LIST OF ACTUAL CONTRIBUTORS TO VOL. XIV.

PROF. GEO. F. ATKINSON, Cornell University, author of the Biology of Ferns by the Collodion Method.

A. B. AUBERT, Professor in Maine State College, Orono, Me.

A. S. BARNES, JR., M. D., Professor in Medical College, St. Louis, Mo.

DR. W. C. BORDEN, U. S. A., Naval Training School, Newport, R. I.

GEO. WHITFIELD BROWN, JR., New York, Inventor of Micro. Apparatus.

REV. FRED'K B. CARTER, Montclair, N. J., Specialist on Radiolaria.

MR. GEORGE CLIFFORD, Paris, France, "No Sig."

ARTHUR C. COLE, London, England, author of Modern Microscopy.

R. B. COUTANT M. D., Tarrytown, N. Y., Inventor of quick method of mounting.

K. M. CUNNINGHAM, Mobile, Ala., Specialist on Diatoms.

EPHRAIM CUTTER, M. D., L L. D., Professor in the College of Physicians and Surgeons, Boston ; one of the fathers of American Microscopy.

ARTHUR M. EDWARDS, M. D., Newark, N. J., Author of Bacillariaceæ.

A. HALY, Curator of the Museum, Colombo, Ceylon.

M. L. HOLBROOK, M. D., New York.

SMITH ELY JELLIFFE, M. D., Brooklyn, N. Y., Specialist on Water Analysis.

JAMES H. LOGAN, Allegheny, Pa.

DR. SAMUEL LOCKWOOD, Freehold, N. J., Late President, New Jersey State Microscopical Society.

E. E. MASTERMAN, New London, Ohio, Expert in Home-made apparatus.

V. A. MOORE, M. D., Bacteriologist, U. S. Dept. Agriculture ; Professor in National Veterinary College.

H. L. OSBORN, Ph. D., Professor of Biology in Hamline University.

HENRY G. PIFFARD, M. D., New York.

GEO. W. RAFTER, Rochester, N. Y., Author of Sewage Disposal in the United States.

ROBERT REYBURN, M. D., Professor in Howard University, one of the Surgeons attendant upon President Garfield during his long struggle with Guiteau's bullet.

W. H. SEAMAN, M. D., Professor in Howard University, Secretary American Microscopical Society.

S. G. SHANKS, M. D., Albany, N. Y., Secretary Postal Microscopical Club.

W. N. SHERMAN, M. D., Merced, Cal., Professional Microscopist.

W. J. SIMMONS, Secretary Calcutta Microscopical Society, Calcutta, India.

CHAS. W. SMILEY, Washington, D. C., Editor of the Microscope.

J. M. STEDMAN, Professor Trinity College, N. C.

A. C. STOKES, M. D., Late Editor, The Microscope, Author of Microscopy for Beginners, Microscropical Praxis, etc.

THOMAS TAYLOR, M. D., Microscopist, Department of Agriculture.

WM. A. TERRY, Bristol, Conn., Specialist in Diatoms.

H. L. TOLMAN, Chicago, Ill., Professonial Microscopist.

R. H. WARD, President Postal Microscopical Club.

A. P. WEAVER, Jackson Miss., Microscopical Indexer.

THE MICROSCOPE.

NOVEMBER, 1894.

NUMBER 23. NEW SERIES.

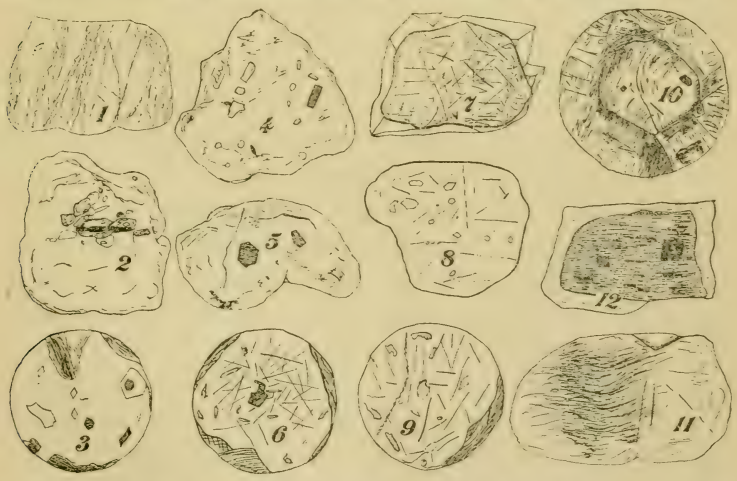
Objects Seen Under the Microscope.

Sand Grains and What We May Learn From Them.

BY WILLIAM MACKIE,

ELGIN, ENGLAND.

If we were to take 100 grains of sea sand from the seashore, and examine them under the microscope, with the view of determining their characters, we should prob-



ably find that, out of that number, 86 were quartz grains, perhaps about 6 felspar, perhaps 2 garnet, perhaps 1 mica and the remaining 5 indefinite, consisting possibly of quartz or felspar stained past recognition with oxide of iron (rust), chips of schistose rock, and others of whose characters perhaps no opinion could possibly be given.

Passing from sea sand to the sand grains of our sandstones, we should find very much the same thing obtained. Sea sand forms, perhaps, the mean between the extremes in composition of the various sandstone beds. These, I find, vary from

72 per cent to 96 per cent for quartz,
16 per cent down to 0 per cent for felspar,
2 per cent down to 0 per cent for garnet,
5 per cent or 4 per cent down to 0 per cent for mica.

Occasionally one or two other unimportant minerals are added, but these are of little interest so far as the purpose in hand is concerned.

Now, why, first of all, this enormous disproportion between the number of quartz grains and the other constituents? Sandstones, as you all know, are derivative rocks. The substances of which they are composed did not exist from all time as integral parts of the present sandstones. These rocks have been built up of the fragments of older, of pre-existing rocks. To anticipate for a moment some of our results, I find that these sandstones have been largely derived from the waste of gneiss and granite. Now, both of these contain felspar in quite as large proportion as quartz. Why does this not appear in the result—I mean in the re-formed sandstone? Because the felspar is more easily broken down, breaks down into finer dust, and is, consequently, washed faster and farther away than the quartz, which, being the hardest, most resistent of our widely distributed minerals, remains behind in larger, heavier grains, and so the process of separation is effected. The mica, which is also a constant constituent of the original rocks, being more easily buoyed up in virtue of its flat, scaly condition, is easily floated away, and hence the quartz is left, as one might say, in almost sole possession of the field.

Now, our object is to trace these grains of quartz back to the rocks whence they were originally derived. If these grains were composed of perfectly homogeneous

quartz—that is, of absolutely unqualified or unadulterated oxide of Silicon—for that is what quartz really is—we should be able to learn very little regarding their previous history. The shape, size, and surface markings of the grains might tell us a little. When, for instance, we come across a grain striated as in figure 2, a striated grain of quartz from Boulder Clay, our thoughts at once go out to glaciated boulders and the Ice Age. It is like a miniature glaciated boulder, and is sufficiently realistic to give one a cold shiver. It is from the pit of Boulder Clay behind the Morayshire Combination Poorhouse, and many more—perhaps not all so finely marked—are to be found among the quartz grains of the Boulder Clay. As many as 15 per cent I find from my analyses are described under the heading "Striated." No doubt the friction of sand particles against one another under water causes many indefinite scratchings of their surfaces, but when we get several deep and roughly parallel groovings, such as we have here, I think we are justified in calling in the agency of glacier-ice as a more efficient cause. Our sea sand, again, by common consent acknowledged to be largely made up of the washings of old Boulder Clays, shows about 10 per cent of such striated grains; while among the sandstones they are seen particularly at Scaat Craig, which shows 8 per cent and among the rougher beds of Newton, 10 per cent of which are also noted as "Striated." The existence of striae in these latter confirms the theory of recurring glacial periods at various times in the remote geological past. One curious result that emerged from amid our maze of figures was the very significant one that a very large proportion of the striated grains are of granitic origin. This is equally true of the recent, as of the early, manifestations of glaciation. The explanation, probably, is that the operations of glacier ice were for the longest period, and in very large measure, confined to

the recesses of remote granite mountains, or, generally, its action was most strongly exerted in these localities. The fact, whatever its interpretation, remains, and though it did not lie in the particular line of our investigation, it is sufficiently interesting to be recorded as a bye-product.

The size and shape of the grains tell us very little of their previous history. If they are much rounded, we infer much tossing about the world, and a long journey from their original home to their temporary resting place in the sandstones. One would think that the smaller grains would naturally be the most rounded, from long tear and wear in transit from place to place. That, however, is not so. So far as the Elgin sandstones are concerned the very reverse is the case. The larger grains are almost invariably the more rounded. The reason, I think, is evident. The larger grains from their weight are more apt to be rolled along by the force of water, while the smaller are, so to speak, floated along, and hence do not suffer so much attrition from contact with other grains. So much for the adventitious characters of our sand grains. They practically tell us very little about their previous history.

Fortunately for our purpose quartz grains are not always homogeneous, and when we come to look at them closely with the microscope a whole vista of possibilities of learning something of their life history at once bursts on our astonished vision. If we look at quartz grains with a moderately high power of the microscope we find that many of them contain numerous little objects—some of them beautifully shaped, some of them beautifully colored, all of them essentially wonderful. These are what we call inclosures or inclusions in the quartz. They are sometimes other minerals in their regular crystalline forms enclosed in the quartz. Let us make certain what an inclusion really means.—Concrete examples of

inclusions, large enough to be seen with the naked eye, may be seen *e. g.*, quartz in felspar ; garnet in mica ; tourmaline in quartz.—Some of the quartz grains are perfect little museums of other minerals. But inclosures are not always minerals. Sometimes they are little spaces, little lakes—lacunae as we call them—filled or partially filled with fluid. Sometimes the fluid is pure water. Sometimes it is water saturated with common salt or other alkaline salt, and then little cubes of the salt may sometimes be seen lying loosely at the bottom of the cavity. Some of them, as an enterprising chemist has shown, are filled with carbonic acid in a liquid state. Note the internal pressure that implies. In some, again, a minute bubble of gas is seen floating along the top of the fluid as in a spirit level. When you turn the crystal round the bubble may sometimes be seen to move. When the cavity is very minute the bubble may have a spontaneous movement, and may be seen darting like a living thing from side to side and from end to end of the cavity, then returning to its original position, only to set out on its ceaseless round once more. It is not our purpose to go into the reasons why these inclosures are present in quartz grains. It is sufficient for the end we have in view that they are there, and that we learn something of the grain that includes them because they are included in it. We may classify inclusions into several groups :—

1. Those with regular mathematical outlines, shortly known as regular (figures 2, 3, 4).
2. Acicular, or fine needle-like inclusions (figures 6, 7).
3. Spirit-level.
4. Irregular outlined.

I. The regular forms are almost always crystals of other minerals. Among those that come under observation in our investigation may be mentioned quartz as an inclusion in quartz, garnet, black mica, chlorite, rutile, kyanite, apatite, &c. It is a case of identity we

are going to prove, and you know you can swear to a person's identity in a court of law without knowing his name. Rounded or ovoid fluid inclusions without gas bubbles are classified as regular.

II. Acicular. These are fine needles, sometimes very fine indeed; sometimes so fine that under the microscope they appear as Tennyson might have put it, "as a finer line in light." They are usually straight—a dead straight—and I know of nothing that so nearly represents the technical definition of a line as "length without breadth" as do some of these needles. Occasionally, however, we see a zigzag one running right through a crystal, and appearing to the eye very much the same as the forked lightning of the "Old Masters." These needles are generally fairly equally distributed through the grains, though, occasionally, they colonise in a particular part of it.

III. The spirit level kind hardly comes under observation at all. If they do, they are usually associated with members of the regular group, under which the grain is, in that case, classified.

IV. Irregular inclusions are very indefinite in shape and size. Some of them are empty, when they appear nearly black, as if the grains were daubed over with black ink spots. Some of them contain fluid with or without a bubble of gas. They are often so small that with ordinary powers of the microscope the grain appears inclusionless, and is so classified in the results. This source of error is, however, of no importance.

Now, you ask what is the meaning of all this. What use is it to be put to? My thesis—my contention is this—that, by reason of these inclusions, we are enabled, with very great certainty in many cases, to refer the individual grains to their parent rocks. Just in the same way as a geologist well acquainted with the geology of a district may go to a pit of Boulder Clay, and picking

up stone after stone would say to himself—"This is granite from the Central Grampians;" or, "this again is gneiss from somewhere between the Nairn and the Spey, this micaslate with garnets from the head waters of the Nairn," and so on. And just as the geologist may at times be able to refer a rock to a particular and very definite locality, at other times only to some indefinite point of a very wide range of country over which it may be known to exist *in situ*; so we, in virtue of these inclusions, may be able to refer our quartz grains sometimes to a very definite locality, sometimes only to an indefinite point of a very wide track indeed.

Now, it may be stated as broad generalities—to which I do not venture to say there are no exceptions—that regular inclusions are to be found in greatest numbers and in highest perfection in gneiss; that acicular crystals have their natural home in granite, and the irregular group also claim the same origin. Examples are shown of regular inclusions from gneiss of Findhorn and of Sloch-na-Muich (figure 3); the whole of which are paralleled by examples of regular inclusions in quartz grains from the whole of the series of the Elgin Sandstones (figures 4, 5,) they exist in varying proportions—from 14 per cent in Spynie to 48 per cent in the sea sand of Lossiemouth. Unfortunately, however, for our hope of establishing a rigid generalization, the local granites are found to contain regular inclusions in greater numbers than I can remember to be the case in any granites I have ever examined. This is due to the fact that all, or mostly all, of them have been derived from the gneiss by passing through a higher stage of the same metamorphic process which originally produced the gneiss itself—in other words, the process that produced the gneiss has gone a step farther and produced granite. There will, therefore, occasionally be some little difficulty as to the origin of a particular grain on this score; but means

have been taken to keep the error from this source as small as possible. As a rule, however, grains with regular inclusions are to be referred to the gneiss as their original home.

The acicular group has proved a very interesting one, for the reason that I have been able to trace most of them to very local and very definite origins (figures 6, 7). The group may be divided into some seven sub-groups, as follows:

GRAINS WITH ACICULAR INCLUSIONS.

1. Closely packed needles in clear quartz.
2. Closely packed needles in smoky quartz.
3. Associated with red or violet or dark hexagons.
4. Sparsely packed in yellowish quartz.
5. Associated with clear regular inclusions.
6. Zig-zag needles.
7. Very dark closely reticulated; only two specimens seen.

You will observe that all of them are granites. I think I have already sufficiently described all the members of the group, except, perhaps, group 3 (figures 8, 9). It is a very interesting one indeed. Sometimes the hexagons and needles are mixed up in inextricable confusion. At other times a needle starts out; it is interrupted; a few well-formed hexagons succeed at intervals along the same definite line; then the series is closed by another needle similar to the first, still extending in the same line. Sometimes a needle breaks into a series of very indefinite dots, to merge again into another needle at the other end; or again, lines of dots take the place of needles altogether. This is what we see with ordinary powers of the microscope, but, when we pass to higher and higher powers, these indefinite dots are found to resolve themselves into regular hexagons, in all respects similar to the larger. It is the old story of Herschel and the star-depths over again—only here rehearsed at the other pole of infinity. The more he increased the powers of his telescopes, the more and more did the hazy nebulæ

of space tend to resolve themselves into clustering groups of stars. The more we increase the power of our microscopes, the more and more does the indefinite dust of our quartz grains tend to body itself forth into definite crystalline forms with individualities as strongly marked as the starry worlds of space.

The evidence of the presence of quartz grains derived from Benrinnes granite is particularly convincing. That the three first groups of acicular grains should be found side by side in the sandstones, and in the granite is proof of identity beyond the possibility of dispute. The evidence of the presence of Ardclach granite is not so strong, though it is still considerable. With regard to Kinsteary, the whole case has not been stated. Let us study for a little the structure of this remarkable granite, which, in some respects, is very peculiar indeed. Here is a section of Kinsteary granite (figure 10). The first peculiarity of it is to be found in these grains which I have called "cleaved grains." These I believe to have been at first felspars—the original felspars of the granite, but at some period of its history the granite underwent a process of re-cooking, when new felspars began to crystallize round other centres, and in the process they robbed this earlier set of their basic constituents, and left them with the cleavage of felspars, but chiefly composed of quartz. Then, by the pressure of these young and growing felspars, their cleavage, while they were still in a plastic condition, was deformed and thrown into irregular wavy lines (figure 11). Now, similar grains occur in the sandstones from Newton upwards and, as if to make assurance doubly sure, a crystal of this ruby mineral, a cube of black magnetite, or a fine needle, as here, is added.

Again, as has been hinted, the felspars of Kinsteary are peculiar (figure 12). They show a dark nucleus often containing grains of magnetite with a clear margin

all round. Similar felspars have been seen in almost all specimens of the sands examined from Newton upwards.

There is also some evidence to show that quartz grains from the granite twenty miles up the Nairn, are also to be found among the grains of the upper members of the series. These consist of grains made up as it were of many smaller quartz crystals seemingly dovetailed together. They produce a peculiar effect when examined with polarized light; and the grains in the granite and the sandstones have this effect in common. Such grains are also to be found in some of the other granites, but these are the most typical, and correspond most closely to the grains in the sandstones.

It should be stated, that when sand grains are built up into sandstones, secondary quartz is apt to be deposited around the sand grains by water containing silica in solution percolating through the beds, and depositing it between the original grains. When we come to examine the grains after separation for the purpose of analysis, they often have clear bands of this secondary quartz around them (figure 7). But when we have discounted all this secondary quartz in the Spynie sandstones, there are many grains that do not differ widely from regular mathematical forms. Now such grains do not occur in granite, they do not occur in gneiss. The only rock I know that shows such grains is quartz-felsite—which is nowhere, so far as I know, found *in situ* in this locality now, but is common in two varieties among the pebbles on the shore at Lossiemouth.

[We quote the foregoing, which will prove of the greatest interest to our readers, from a pamphlet Entitled "Sand Grains," which is for sale by Alexander Watt, 144 High Street, Elgin, England, to whom we advise our readers to apply for the entire treatise of 32 pages. Enclose 30 cents to him in the form of an International Money Order.—EDITOR].

Another Note on Mr. Cunningham's paper on the Animality of the Diatom.

By ARTHUR M. EDWARDS, M. D.
NEWARK, N. J.

I did not intend to notice Mr. Cunningham's paper in the August number of the MICROSCOPICAL JOURNAL because I did not think it worth noticing. There are enough idle papers written on microscopy and if an observer tries to answer all, his work may be endless. But it has called forth a note on the errors in practical microscopy in Mr. C's paper, from Dr. Stokes, which is published in the October number. I let that pass. I think that Dr. Stokes has pointed out the errors in a mild spirit. I cannot let the errors in way of the Diatoms pass so easily. And I wish to say something about the animality of the Diatom itself. That the Diatom is an animal, of course with Dr. Stokes *I* do not believe.

What is an animal? And what is a vegetable? And how can one state be proved more thau another by any optical method? Is an animal something that takes in oxygen and gives off carbonic acid? Is a vegetable something that takes in carbonic acid and gives off oxygen? And what are those things, the fungi for instance that do neither? And can one organism be proved an animal or a vegetable by optical powers? I think not. Now I do not wish to attack Mr. Cunningham personally, for personally he is my friend, but I do wish to attack his theories as to the animality of the Diatom. No optical appliance better put together than his impossible contrivance will be sufficient to prove or make others see that the Diatoms are animals. I mean the Bacillariaceæ. For that is the whole individual,—be it animal or be it vegetable or be it protiston. The Diatom is the siliceous shell of a prepared Bacillarian. Bacillariaceæ are not vegetables and are not animals, but are something having animal and vegetable properties,—in short protista.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Made an Assignment.—The announcement that any business firm has suspended carries with it a feeling of regret. There is not, however, surprise in a case like that of Queen & Co., considering how they have tried to do business in recent years. Frequently there have come to our notice reports of peculiar doings, which we have regretted to hear and have refrained from publishing.

Only a few weeks before the assignment, they asked if we would send out their "clearance sale" list of second-hand and shop-worn goods with every copy of our periodical. To do so would be an infringement of the postal laws regarding second-class matter and we promptly declined to do it. To pay fourth class postage on our entire edition would have cost them much more than a legitimate advertisement.

Personal.—W. P. Manton, M. D., formerly an editor of this periodical, has published a Syllabus of Lectures on Human Embryology. It is for medical students and practitioners, and contains 70 drawings and photo-engravings.

We hope that Dr. Manton will sometimes favor us with contributions in spite of his very buisy life and practice.

Pure Food.—At the recent Pure Food Exposition in this city, our friends of the *Popular Health Magazine*, gave a series of demonstrations Microscopic and otherwise which atracted much

attention. Drs. Thomas Taylor and Theobald Smith rendered assistance. F. W. McAllister and G. T. Sadtler's Sons loaned some microscopes for the purpose.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

206. *How can I breed eels in paste, for use under the microscope?—Inca.*

Add some old vinegar containing eels to cold, boiled flour paste. A sample of paste containing eels may often be found in a bookbinders paste pot.

207. *Where can I get a work on Bacteria that will give illustrations similar to those in the March Microscope, but enlarged so that I can make out the cell walls?—S. A. K.*

Sternberg's Manual of Bacteriology, published by Wm. Wood, Co., price $9,00, will probably supply your needs.

208. *Can you give a good and easily prepared stain for tubercle bacilli?—C. F.*

The Ziehe Carbol-Fuchsin is a good formula:

Fuchsin (Magenta),	1 part.
Alcohol,	10 part.
Solution carbolic acid in water (5 per cent)	100 part.

Mix and filter. This solutions will keep well. Stain the sputa about 5 minutes cold, or half that time if warmed. Clear up the diffuse staining with a 5 per cent solution of sulphuric acid for ½ to 1 minute.

209. *What is meant by "immunity," or cures produced by injections of something?—J. A. B.*

Immunity is a protected condition resulting from a first attack of a disease, like small pox or measles. A more or less complete immunity is produced by inoculation with cow pox virus, to protect from small pox. At present an animal, say a goat or a horse, is repeatedly inoculated with a pure culture of

tetanus or of diphtheria, commencing with a minute quantity, until a condition of "tolerance" is produced, which will resist an ordinarily fatal inocultaion. The blood and serum of the animal then contains an *antitoxine* which in some way, not yet understood, protects it against further infection. This serum injected into another animal, confers upon the same immunity or resistance. This serum is being used, by injection with a hypodermic syringe, in cases of diphtheria, and it is reported to have materially reduced the death rate in that disease.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Fresh Mounts.—Fresh mounts should be placed in trays and kept horizontal until the mounting medium and the rings used have hardened. *Always place a slip* upon or under the slide, containing the name of the object. If this latter suggestion be disregarded, it is surprising how soon the name of an object can be forgotten and the mount thereby rendered useless.

How to Obtain Foraminifera from Chalk.—The following is probably an improvement on the methods usually given in books. The chalk to be used must be native chalk, the sticks of chalk used in schools is ground and prepared and will not answer the purpose. Carpenters chalk is native unprepared chalk.

Boil some fragments of chalk in a strong solution of Glaubers Salts (Soda Sulphate) set aside to cool and crystallize. This separates the chalk into a powder, then by repeated washings and settlings, the salts and the light fluffy debris are washed away and perfect shells obtained in the sediment.

Preservation of Algæ.—Algæ keep well and preserve their color when mounted in a solution of hydrate of chloral. The following is also a fine medium for this purpose. Camphorated water and distilled water each 50 grammes, glacial acetic acid, .5 grammes, crystallized chloride of copper and crystallized nitrate of copper, of each, .2 grammes, dissolve and filter.

Fixing Objects to a Slide.—In arranging diatoms, spicules,

butterfly scales, etc., etc., many a slide has been ruined and much patient labor wasted by attempting to cement the object to the slides with common mucilage. The following recipe will afford better and more satisfactory results.

Selected pieces of gum Arabic are dissolved in distilled water so as to form a thin mucilage. This is filtered, and the filtrate poured into a considerable volume of alcohol, which precipitates the arabin. This is separated from the mother liquor by filtration washed with alcohol and finally dried.

For use, dissolve a small portion in water and apply a thin film to the slide with a camel's hair brush. As each diatom or object is mounted, gently breath upon it and the moisture will fasten it to the slide.

Crystal slides.—Make a cold saturated solution of a salt; then heat the solution so that it will dissolve still more of the salt. A cell is then filled with the warm solution, and immediately sealed. Upon cooling, the crystals will be deposited within the cell in a most beautiful manner, and their lustre will be retained. Gold size is a suitable cement for slides prepared in this manner.

SCIENCE-GOSSIP.

A Comple Set.—One of the very few men who have complete sets of *The Microscope* and *Microscopical Journal* from 1881 to date, is Dr. E. F. Hodges, of Indianapolis. He also has the Journal of the Royal Microscopical Society complete. These sets are of great value for reference and when sold command a high price.

Fermentation.—Evening classes for the study of fermentation are to be held by Prof. F. W. Fellowes, 61 Chancey lane, London. There will be six weekly lectures of especially interest to brewers, bakers and analysts, with practical demonstrations.

Fruit Skins.—The bloom of a peach is a luxuriant growth of microbes. All fruit skins carry germs and so should never be eaten. for the stomach may enable them to multiply indefinitely especially in old or feeble persons.

Microscopical Praxis.—This is the name of Dr. Stokes' new book, just issued. It will be of much assistance to the student.

THE MICROSCOPE.

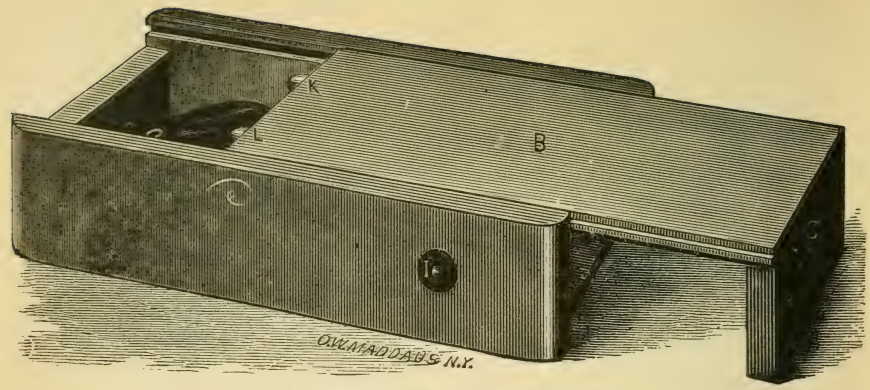
Contents for November, 1894.

Objects Seen Under the Microscope. Sand Grains and What We May Learn From Them, by William Mackie. (Illustrated).... 159
Another Note on Mr. Cunningham's Paper on the Animality of the Diatom, by Arthur M. Edwards, M. D. 169
EDITORIAL.—Made an Assignment. 170
Personal 170
Pure Food. 170
QUESTIONS ANSWERED.—Nos 206-209. by Dr. S. G. Shanks. 171
206. To Breed Eels in Paste 171
207. Illustrations of Bacteria 171
208. Prepared Stain for Tubercle Bacilli. 171
209. Immunity, or Cures Produced by Injections of Something 171
PRACTICAL SUGGESTIONS.—By L. A. Willson. 172
Fresh Mounts. 172
How to Obtain Foraminifera From Chalk 172
Preservation of Algæ. 172
Fixing Objects to a Slide. 172
Crystal Slides 173
SCIENCE-GOSSIP.—A Compleet Set 173
Fermentation. 173
Fruit Skins. 173
Microscopical Praxis 173

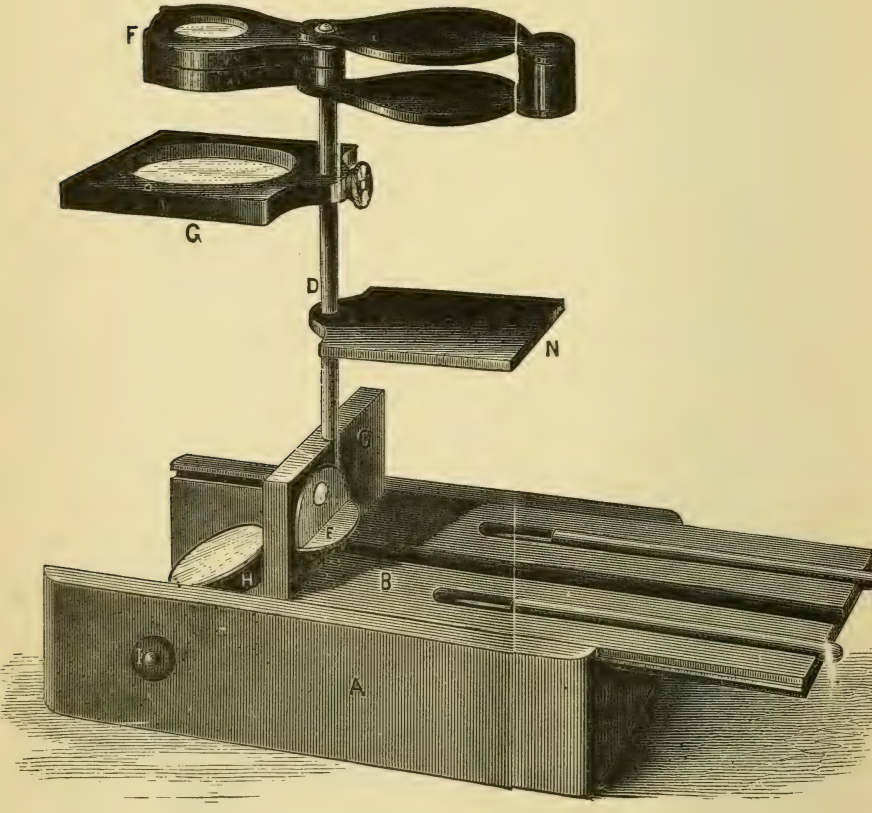
THE MICROSCOPICAL JOURNAL.

Contents for October, 1894.

On the Limitation of Tuberculosis, by Dr. W. W. Alleger 289
On Species in the Desmidiæ, by Arthur M. Edwards, M. D. 299
A Study of the Microscopic Phenomena of Commencing Inflammation, With Special Reference to the Diapedesis of the White Blood Corpuscles, by Chas. F. Craig, M. D. 301
Microscopical Technique Applied to Histology.—VII 314
The Character and Uses of Glycozone, by Cyrus Edson, M. D. 318
EDITORIAL.—The Practical Value of the Microscope 320
MICROSCOPICAL APPARATUS.—Construction of Microscope Stands. 320
MICROSCOPICAL MANIPULATION—Simplification of Laboratory Methods 321
MEDICAL MICROSCOPY.—A Study of Palsy 322
BIOLOGICAL NOTES.—The Smallest Known Flowering Plant 322
MICROSCOPICAL SOCIETIES.—Lincoln Microscope Club, Roscoe Pound, Secretary. 323
MICROSCOPICAL NOTES.—Microscopical Praxis 324
Inoculation of Warts 324
Primary Dissecting Microscope 324



THE EXCELSIOR MICROSCOPE BOX



THE EXCELSIOR MICROSCOPE.

THE MICROSCOPE.

DECEMBER, 1894.

NUMBER 24. NEW SERIES.

A Microscope for Children.

BY CHRYSANTHEMUM.

WITH FRONTISPIECE.

There is no good reason why boys and girls should not early commence the use of a microscope and derive great pleasure and instruction therefrom. We shall be glad to help interest young people in the beauties which are just beyond their sight, to create a love for natural science, teach them carefulness and observation and thereby furnish instructive enjoyment for many leisure hours. They can examine common objects, such as the house fly, the butterfly, the ant, spider, honey bee, garden and flower seeds, pollen grains, etc. We can tell them the best ways of seeing things, the most interesting parts to study and also give curious or instructive facts concerning them. We shall next year give some illustrations of the objects to be studied and point out the different parts so that the beginners may know just what to see, and how to show their friends some very interesting things. Subscribers have the privilege of sending in objects or may describe to us what they have found of interest. For this work any simple microscope or low power compound microscope may be used. There is a convenient little dissecting microscope, which will always be of use even if one has a larger instrument, and which we shall describe. It is shown in the frontispiece. We shall give some directions for seeing the objects that can be studied with this instrument, so that

a boy or girl of ten or twelve summers may soon learn to find much enjoyment with it.

This instrument consists of a small wooden case the exact size of that shown in the engraving. To one end of the lid of this box is attached one of the ends of the box and when the lid is reversed and turned upside down it may be slid into the groove of the case and then it forms a stand for the lenses, F, and glass stage, G, as shown in the large figure. The lenses and stage are supported by the steel rod D, the lower end of which is hinged to the lid, so that it may be turned down into the groove provided for it. The glass stage G, which is fitted to a frame of hard rubber, slides easily on the rod D so as to be readily adjustable for focus and can be fastened at any desired height by means of a set screw. This glass stage is set in such a manner that when reversed it forms a cell for holding liquids. In this cell aquatic animals may be examined at leisure. The frame that holds the lenses fits to the top of the stem. A mirror, H, is fitted to the box and is easily adjustable, by means of the button shown on the outside, so that the light may be reflected up through the stage when a transparent object is to be viewed. When it is desired to use reflected light a dark ground of hard rubber is provided which is carried by the stem D. The lenses are well made by one of our best optical firms, are three in number and so arranged that they can be used singly or together, their magnifying power varying from five to thirty diameters. They are provided with a proper diaphragm which secures distinctness of vision. If very carefully adjusted the corpuscles may be distinguished in the blood of a frog.

This instrument sells for the very low price of $2.75, but in order that many young people may become interested in microscopy we will for $2.75 send them THE MICROSCOPE for 1895 and one of these instruments, which

is equivalent to presenting them with a year's subscription if they buy one of these splendid little instruments. The instrument will go direct from the factory to the subscriber in a nice little box and is guaranteed by the maker to be in perfect order.

Whoever can get us five new subscribers prepaying one dollar each for 1895 will receive one of these microscopes as a premium free of all cost. The name of this instrument is the Excelsior Microscope.

Aquariums for Microscopists.

By M. J. TEMPERE,

PARIS.

Translated from *Le Micrograph Preparateur.*

For nearly eight years, I have had upon two of my tables, one facing the North and the other the West, half a dozen small aquariums, in four of which, water has not been completely changed but twice, and in the two others but four or five times during that period.

I have noted from time to time all the different microscopical organisms which developed in them and of which the number amounts to almost three hundred. Considering the years and especially what I have occasionally introduced in them, I have been able to grow certain organisms in quite an important quantity and in the best possible conditions.

The number of species of Diatomaceæ, of filamentous Algæ, of Desmidiaceæ and of Infusoria were greatest; then come the Larvæ, the Worms, the Entomostraca, etc.

The pleasure and interest which can be found in following the developement of such a great number of interesting objects, cause me to believe that many of our readers will try to do as I have done. As will be seen, nothing is easier. My aquariums contain—one a litre and the other half a litre. They are simply right-

angled tanks of glass which are used for making certain electrical piles.

I prefer that kind of tank to the cylindrical ones, because they facilitate observation. Many organisms adhering on the inner side develope there more uniformly and light strikes them in a more equal manner.

To commence these aquariums, after rinsing them well they should be filled three-quarters full with fountain or river water as pure as possible. The gatherings made in a pond or any pool whatever may consist of the washings of floating leaves of potamogeton, of neuphar, of stems of typhlina, of scirpus or of any other aquatic plants of that kind; or, of a certain quantity of water from the pond or the pool itself. This should be taken in a spot where many organisms have been seen in suspension. Even a small portion of these floating masses which are frequently found at the surface of water may be taken. Oftentimes, these contain quite a number of different things. Then, in each vase, should be placed one or two stems of a small aquatic plant, such as Nitella, Elodea canadensis, Callitriche aquatica, Ceratophyllum demersum, Pilularia globulifera, some Lemnia and one or two small-sized mollusks, 6 or 8 millimetres long.

The orifice of the vases must be covered with a simple pasteboard of the form of a box-cover wide enough to let the air go in without admitting the dust. The aquariums thus prepared are then placed in a lighted place but well out of the sun's rays. About every fifteen days, a little water is added in order to offset evaporation. That is very important. The water is added slowly and dropped on the side of the glass, so as not to disturb the water of the aquarium.

During all the year, even in winter, the presence of living and numerous organisms will be noticed, but it is especially from August to November when the surprises will quickly succeed each other.

The height of the tallest of the tanks of which I have spoken being but 16 millimetres, it is easy to raise the objects which it is desired to examine with a pipette provided with a rubber bulb.

I will speak, in the future, of the special cultures that can be made with these aquariums. Meanwhile I shall be much pleased to hear from some of our readers who have tried and succeeded.—Rene Samson.

A Newly Discovered Cause of Typhoid Fever.

Recently the College communities at Amherst and at Wesleyan University were startled by the development of a considerable number of cases of typhoid fever. In response to an inquiry addressed by us to H. W. Conn, Professor of Biology in the latter College, we have received the following statements which show what the microscope can do in combatting this disease which is to be so much dreaded:

First. We have had quite a number of cases of typhoid here. I say have had, for although several are still sick, there have been no new cases for two weeks and as you will see, we have reasons for not expecting more.

Second. The wells were of course suspected and their use immediately stopped, but investigation showed that they were not the cause, for at least three reasons. Several of the sick men had not used the wells, towns people used them freely and have not been sick, and bacteriological study showed no pathogenic germs in the wells.

Third. We have found that all cases are in *three* fraternities (with explainable exceptions) and have *demonstrated* that the cause of the trouble was a lot of raw oysters which were eaten on October 12, at the initiation suppers. These oysters came from a creek where they had been allowed to lie within three hundred feet

of the outlet of a sewer, and at the time the oysters were collected there were two cases of typhoid fever within a few feet of the creek pouring their excreta into the sewer. All these facts together have demonstrated that the trouble was due to these oysters. Oysters from the same place went to Amherst and produced a number of typhoid cases there. All our cases appeared within three weeks of the initiation suppers, and none of our young men suffered that did not eat these raw oysters. I will not attempt however to give you all the details now. They will be published later.

Doubtless it may be a disgrace to have typhoid but in this case it was a disgrace of ignorance on the part of the oyster planters who had no suspicion that any evil results would acrue. I think you will see that it is not the fault of any one here at Middletown for it is unique to find typhoid thus traced to oysters.

We are much pleased to know that our Alma Mater has so capable a bacteriologist in its employ and are especially gratified to know the dangers attendant upon eating raw oysters. In a few years, typhoid and many other zymotic diseases will have come under as complete control as is small pox. Suspected oysters may now be tested for typhoid germs and their presence clearly demonstrated, but many more people should learn how to do such work and become guardians of public health.

Railroad Microscope Stage.—A simple and elegant form of microscope stage has been devised by Mr. J. P. Swift, of 81 Tottenham Court Road, W., London, the adjustment depending upon the principle of the friction-roller, instead of that of the gear-wheel, or screw. The friction-rollers, whereby the carriage is moved backwards or forwards over the table, are provided with milled thumb screws. Obviously the adjustment is one of great precision and simplicity.—*The Optician.*

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Primary Dissecting Microscope.—Manufactured by the Bausch & Lomb Optical Co., Rochester, N. Y. This Microscope was designed by Prof. C. R. Barnes of the University of Wisconsin and has been in use in their and other laboratories for several years with very satisfactory results. It is a most effective and low priced dissecting instrument.

The body is a solid block of wood so shaped that the sides serve as hand rests. The advantage of this is that the block practically forms a part of the table on which it rests and is then very steady to work upon. Mirror and movable glass stage are provided for in a very simple manner. The lenses are carried in an arm, the post of which slides in a metal sleeve, thus allowing the entire stage to be covered and giving sufficient rays and accuracy of focus. A square plate black on one side and white on the other is arranged to slip under the stage for dark or white ground. A groove on the lower side of the block receives the plate when not in use.

Clark's Book for Beginners.—We call attention to this book again in order to offer it as a premium for two new subscribers.

One wholly unacquainted with the microscope may, by following the simple, clear, and concise directions, be sure of reaching successful results. The processes have in all cases been simplified as much as is consistent with good results. Re-

gard has also been paid to the expense of apparatus, and the processes are adapted to apparatus of the minimum cost.

Features of the book are: the clear statement of the principles of light as they find application in the microscope; the discussion of polarized light, a subject of considerable practical importance, but one that is often inadequately treated in the books on the microscope. The detailed descriptions of the processes necessary for the preparation and examination under the microscope of the various classes of objects that are to be studied in the different branches of science usually pursued in secondary schools, are interesting and attractive.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

209. *Where can I obtain literature bearing directly on paraffin imbedding?*—Chambliss.

We can supply you with any of the following:

American Monthly Microscopical Journal, March, 1893, pp. 75-6.

Microscopy for Amateurs, pp 19-20, 25 cents.

Modern Microscopy, Cross & Cole, p 72, $1.25.

Practical Methods in Microscopy, Clark, p 108, $1.60.

Medical Microscopy, Wethered, p 60, $2.50.

Botanical Technique, Humphrey, p 31, $3.00.

210. *My query, No. 202 in the October number of the Microscope, was not precisely answered. I refered particularly to the Wenham microscope stand. Is such a stand manufactured?*—R. Rich.

The Wenham stand is manufactured by Ross & Co., London. It is an old style instrument, complicated in form, and intended to facilitate the use of very oblique light on the object. Modern high-class objectives have made such a stand unnecessary.

211. *Can you give me a simple method for Mounting Starch.*—G. Dalton.

The starch must be perfectly dry and crushed to a fine pow-

der, if at all lumpy. Take a clean glass slip, place a very small drop of liquid balsam on the center. Let some of the fine starch fall into the balsam from the point of a knife. Set the slide away for 24 or 36 hours, covered from the dust. When the balsam is slightly hardened, shake off the surplus starch, drop a little fresh balsam on the hardened mass, put on a cover-glass. Place a weight or clip on the cover and set aside to harden completely. The first or hardened drop of balsam will soften slightly and spread uniformly carrying with it the starch. Two specimens of starch may be thus mounted under one cover for comparison and be kept separate.

212. *I have just come into the possession of a microscope, but know very little about its use. How may I best become an expert with it?—REV. J. J. Z.*

Clark's Practical Methods in Microscopy, published by Heath & Co., Boston, will teach you how to use the microscope and how to prepare objects for microscopic examination.

213. *I have a full line of Zeiss objectives and a Photomicrographic outfit. What is the literature of the subject and what dealers in supplies do you recommend?*

The A. M. M. J., for 1886 contains a very full continued article by R. Hitchcock. The volumes for 1890-91 and '93, also contain valuable articles on Photomicrography. Clark's Practical Methods in Microscopy, contains a practical article on the subject. Supplies may be had from any good dealer in photographic supplies. See our advertising columns.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

How to Mount Objects in Motion for Examination by Polarized Light.—Use a rubber cell 1-16 of an inch deep and 3-4 cover. For a medium, use Canada balsam thinned with not quite an equal bulk of spirits of turpentine. Stir well together and when dissolved filter through cotton. Cement the cells to the slide with something not acted on by turpentine—for example, shellac, or sealing wax in alcohol. The objects

may be little fresh water oysters, quartz, agate, sand or any object that polarizes and does not dissolve in turpentine. The objects are kept in motion by reversing the slide. Such slides are novel and entertaining and nearly always excite the wonder and admiration of friends.

Ceratium.—This animal is a flagellate infusorian. It is in the form of a hard shell with a long sharp peduncle and three horns or processes at the top. The animal lives encased in the shell and communicates with the outer world only by means of its flagellum. It is pictured in Dallinger's Carpenter, 7th edition, on page 696. Also in the Century Dictionary, Vol. 1, page 894. At certain seasons, it is found in great numbers in the filterings of water of the Great Lakes. The most interesting feature of the animal is its flagellum. This is easily seen by an ordinary quarter-inch objective. To observe it requires no staining or manipulation.

If a quarter-inch objective fails to reveal the flagellum, it is because it has been drawn in by the infusorian. The animal seems to be timid and the least disturbance will cause it to retract its delicate flagellum. It is best to examine the Ceratium when first gathered as it seems to be very delicate and easily killed.

Opaque Slides with Asphalt.—Place an ordinary glass slip on a turn table and turn a ring of asphalt and fill the interior of the ring with the same substance. Remove from the turn table and burn the asphalt side of the slide over an alcohol lamp. After turning, immediately apply another coat of asphalt and burn again as before. While hot, place a cover glass within the ring and trim the edges with turpentine.

Cells made of a Button.—Procure a rubber button with a rim; drill out the interior containing the holes and leave a flange for the cover glass to rest upon. The edge of this flange will protect the cover. Buttons may be obtained that will exactly fit a 5-8th cover. Fasten the ring to the slip with balsam or with any kind of cement. If the circle be too large for the cover fill it with a drop of asphalt. Very beautiful cells can thus be obtained.

CORRESPONDENCE.

A Reply to Dr. Alfred C. Stokes' Critical Communication, headed "A Note incidently in regard to the Animality of the Diatom, but especially to Mr. Cunningham's method of illumination.—I have duly noted an article under the above caption published in the Oct. number of this periodial coming from the pen of the distinguished Micrographer, Dr. Alfred C. Stokes. Its appearance, as well as its constrution has all the portentiousness of a thunderbolt hurled from Jovian heights.

In a more concise vein of thought, and more to the point; Dr. Stokes' article in my opinion does not rise to the dignity of legitimate criticism; but is more properly that form of critical composition characterized as a "diatribe," for which there is neither excuse, pretence or justification; as based upon anything occurring in my article. Every point that he was pleased to find fault with has been reasonably met in my article; by implication at least, if not in a more cursive manner, and my failure to make some reference to a Homogeneous Oil immersion lens, and chip in a little about the "critical illumination," ought not to indicate on my part any real ignorance of the system of lenses, and illumination more particularly adapted to the study of recent Bacteriology. What Dr. Stokes proposed to substitute for the methods used by myself and suggested by me to others; belongs more to the limited number of workers who provide themselves with either Apochromatic; or Oil immersion lenses to be used more particularly for special purposes, such as the resolution of the most difficult tests, Amphipleura, &c., and when this stage is reached they are often happy and contented in the possession of lenses, of which occasionally a possessor of one ostentatiously announces its angle, resolving power, &c., which sends a wave of envious desire pulsating over the microscopical horizon(?) I might have felt the sting of the want, if it had not been that in a former day, I had received directly from Carl Reichert's own hand, one of his 1-15 inch., Homogeneous Oil immersion lenses, with its appropriate hemispherical immersion illuminating lens to be applied directly in contact with the slide. A record of its use and application in the study

of a preparation of a slide of selected diatoms derived from the surroundings of Mobile and containing some 1500 diatoms, representing many species, was duly referred to in an article entitled "Diatomology," in the A. M. M. J., for November, 1892, under my name. This statement should free me from the charge of indifference to the use of the highest powers and most costly lenses. And on the principle that "enough is as good as a feast," one usually adapts the character and quality of the optical appliances to the nature of the work to be done, or the problem to be solved. This latter choice or preference is essentially what was done in and during the studies leading to the results recorded in "The Diatom considered as a Protozoan," and as the directness of the methods, as well as the relatively simple optical requisites are available to all who have the use of a compound microscope, there need not be any fear of failure to verify all, or some, of the "fine points" as outlined in the article previously named. That form of critical acumen which attempts to wipe out, at a single stroke of "snap-judgment;" and the *ipse dixit* style of decision in disposing of facts and phenomena, fairly obtained through patient, persistent, and intelligent study, and seriously communicated to those interested in science, ought never to find "aiders and abettors."

The unselfish pursuit of science is largely for the establishment of "truths" in all branches of human enquiry, and the consequent eradicating of error, and this is the rule of conduct that guides me.

As a contrast, and to offset the baneful influence of my "American joke" on Dr. Stokes, I take the liberty to state that the article entitled "Studies in the Biology of the Diatoms" in the July Am. M. M. J. secured me a correspondent from Sheffield, Eng., whose initial, and subsequent letters contained complimentary expressions, sufficient to amply compensate for the cold-water *douche* administered by Dr. Stokes and as a result, this correspondent has consented, at the invitation of the Editor of the A. A. M. J. to contribute to the American Journal, recent researches appertaining to the Biology of the Diatoms, which paper, would have eventually appeared in the Journal of the Royal Microscopical Society, and when they appear, the readers will have to thank Dr. Stokes for the success of his double back-action and hammerless critical note, which made the

situation possible. In conclusion, I would invite all interested in the Diatoms, to make the trials, tests and verifications for themselves, before condemning or criticising too harshly the methods which in a moment of unsophisticated thought I deemed worthy of publication.

For sixteen years I have been a reader of one or both of our Journals devoted to Microscopic Science, and of The Microscope during Dr. Alfred C. Stokes' editorial management of it. I had learned to appreciate the brilliant, but somewhat impetuous style of his editorials, and later of his Biological contributions. I envied the facileness of his pen. But when struggling genius spreading its pinions for a trial flight, is rudely struck at, it does not expect to see a friend in exultation.—*K. M. Cunningham.*

On the Animality of the Daitom.—Mr. Cunningham sends us the following which he has received relative to his late paper:

I take the Amer. Mo. Micr. Jour. and had therefore seen your second article which contains much that is of interest to me, although I have not had any reason so far to differ from the views of the Rev. W. Smith and the numerous other diatomists who have followed him in regard to the plant nature of the Diatom. I think it foolish of anyone to be dogmatic on the subject and to refuse to allow those who follow Ehrenberg in considering the possibility of it turning out to belong to the Protozoans to show cause why the question should be re-discussed. I can entirely and positively confirm your observation of the power of the Diatom to move rapidly objects of various size along its surface. Three weeke ago I had the pleasure of observing with a Nachet's ⅛, the comparatively small Navicula radiosa rapidly move a mass of mucous matter of at least a fourth of its own size in which a number of minute grains of sand were embedded, backwards and forwards from extreme end to extreme end of the surface of the frustule (valvular or side view). I counted thirty return journeys of the load during which time the diatom itself was moving about in a very active manner, and the journeys which never ceased for a second while the diatom was in sight would have apparently been continued had not the load been got rid of by the diatom entering a thicket which caught the traveller and relieved the diatom of its burden. Although simple and plausible, I do notbelieve in the en-

dosmose and exosmose theory as sufficient to account for the many and curious variations of movement which I have observed among the diatoms.

I received a card from the Editor of the A. M. M. J. asking me to send him a communication upon the subject of the Biology of the Diatom, and although I had half promised what I am now engaged upon for the R. M. Society's Journal, I am tempted to accept his offer to take part in the interesting discussion in his columns.

It so happened that when on reading your article in the A. M. M. J., I wrote to you asking where I could obtain Prof. Smith's paper from which you had quoted, I had got half through an article illustrated by numerous drawings with the camera lucida, in which I sought to show that my own recent observations tended to throw doubt upon Dr. Miquel's contention in "Le Diatomiste" and to somewhat strengthen Count Castracane's objection to the theory that what since the Rev. W. Smith's time has been generally regarded as a sporangial frustule which is destined to perish after fulfilling the duties of a spore case, is in fact a simple process of nature which takes place for the purpose of the recovery of the size of the diatom diminished to its minimum as a life supporting body by repeated subdivisions. The phenomena which I considered as opposed to the size recovering theory, and as supporting the spore theory were shown very clearly in a gathering which I made last spring and from which I had mounted several dozen successful slides from which my drawings were made. They consisted of (1), many cases of formation of mega-frustules from many sizes of parent frustules of cocconema, there being many specimens of frustules of the same species in the gathering of zies considerably below the size which produced the mega-frustule and which Dr. Miquel speaks of as the minimum size which necessitates the auxospore and (2) many hyaline cysts in the same gathering as that in which the formation of the mega-frustules are so numerous which cysts apparently perfect and unbroken enclose, in many instances closely packed together numerous frustules of almost every size down to the most minute of Cocconema and Gomphonema mixed and unmixed and free from all extraneous matter. Prof. Smith's mention in his paper of a similar observation by himself (he curiously enough saw

the same mixture of Cocconema and Gomphonema as that seen n my own slides) and his ingenious explanation of the phenomenon by the vagaries of a rhizopod resembling Actinophrys sol has much impressed me, the more so as I have myself witnessed this creature's curious attack upon the contents of individual frustules, and its emergence therefrom in the shape and with the rays shown in Prof. Smith's drawing, but I am not yet satisfied that the cysts of which I have got many perfectly clear examples in numerous other species are purely imaginary!

Prof. Smith admits the difficulty of accounting for the many minute frustules which abound in most mixed gatherings and which bear close resemblance to the different species of normal size in the gatherings. However, his paper has made me pause and I am making further and more exact observations of my cysts and their contents before writing further.—J. Newton Coombe, Sheffield, England, October 11, 1894.

SCIENCE-GOSSIP.

Detecting Blood.–A chemical authority states that he has discovered a method for detecting blood stains that the microscope has failed to reveal. When the smallest drop of blood is mixed with fifteen grammes of distilled water, and one or two drops of tinture of guaiacum added, a cloudy precipitate of resin is yielded, and the solution becomes slightly colored. When there is further added to it a drop of etherial solution of peroxide of hydrogen, a blue color appears, which becomes deeper and deeper on exposure to the air.—*Science Siftings.*

RECENT PUBLICATIONS.

Transactions of the Hertfordshire Natural History Society. Vol. VII, parts 8 and 9. John Hopkinson, Editor.

We have recently received from the Society a copy of these proceedings which are issued once in two months. They are beautifully illustrated with photo-engravings and contain many interesting papers on general natural history. The excursions to points of interest form an interesting feature of the society's work. We ought to do more of such work in America.

Contents for December, 1894.

A Microscope for Children (with Frontispiece) 175
Aquariums for Microscopists. Tempere 177
A Newly Discovered Cause of Typhoid Fever 179
Railroad Microscope Stage 180
EDITORIAL.—Primary Dissecting Microscope 181
Clark's Book for Beginners 181
QUESTIONS ANSWERED.—Paraffin Imbedding 182
Wenham Stand 182
Mounting Starch 182
Literature of Photomicrography 183
PRACTICAL SUGGESTIONS.—By L. A. Willson 183
Polarizing Objects 183
Ceratium 184
Opaque Slides 184
Cells Made with Buttons 184
CORRESPONDENCE.—Reply to Dr. Stokes 185
Animality of the Diatom 187
SCIENCE GOSSIP.—Detecting Blood 189
RECENT PUBLICATIONS.—Hertfordshire Society 189

Newspaper Reporters Wanted.

We are informed that the Modern Press Association wants one or two newspaper correspondents in this county. The work is light and can be performed by either lady or gentleman. Previous experience is not necessary, and some of our young men and women and even old men would do well to secure such a position, as we understand it takes only about one-fourth of your time. For further particulars address Modern Press Association, Chicago, Ill.

Detectives Needed Here.

Superintendent Chas. Ainge, of the National Detective Bureau, Indianapolis, Ind., announces that two or three capable and trustworthy men are needed in this county to act as private detectives under his instructions. Experience in the work is not necessary to success. He edits a large criminal paper and will send it with full particulars, which will explain how you may enter the profession by addressing him at Indianapolis, Ind.

THE MICROSCOPE INDEX.

COMPILED BY HANS M. WILDER, PHILADELPHIA, PA.

Aecidia, 144
Algae, preserved, 172
on the sidewalk, 128
Aluminum, 92
Amœba, how to examine, 13
where to find, 60
literature, 109
Anatomy, human, slides necessary, 93
Angell, Geo. T, his hobby criticized, 59
Antidissection and Antivivisection writers, 59
Antwerp, exhibition, 92
Aquariums, 177
Association, Am. Med., meeting, 63
British, meeting, 43

Bacillariaceæ, cleaning shells, 115
Bacillus, antifever, 3
tuberculosis, with low power, 128
staining quickly, 62, 171
typhus, 3
Bacteria of 20 diseases, 33
deprived of sunlight, 15
living on mineral food, 15
coli communis, 46
literature, 171
Bacteriological work in Medical Science, 82
Bayberry tallow for sectioning, 31
Beach, section of stem, 17
Blood, circulation in lizard and tadpole, 94
detection of, 189
Books:—
Clark's book for beginners, 181, 183
S. H. Gage, Microscopical methods, 46
O. W. Owen, Bacon's cipher story, 78
D. H. Scott, Structural botany, 63
Funny bone, 31
Books,—continued.
Journal of marine zoology, etc., 95, 110
Midland Naturalist, 63
Proc. Hertfordshire Soc., 189

Cell making, suggestions, 56, 184
Celloidin, imbedding, 127, 144
Ceratium, 184
Clustercups, 144
Communion cups and disease, 126
Condenser, substage, 128
Correspondence, 15, 110, 156
Copper, crystals, 61
Cover class, moisture, 8
Crab louse, 129
Crown, Imp'l, section of anther, 114
Crystals, metallic, 61
Crystal, slides, 173

Dairy, use of microscope, 98
Desmids, new, 97
Deutzia, leaves, 155
Diatoms, animality, controversy, 146, 153, 169, 185, 187
Dictyosphærium, new, 145

Editorials, 9, 28, 44, 59, 75, 92, 106, 127, 142, 153, 170
Eel paste, breeding, 171
Embryo chick, mounting, 77
Eyes, should be kept open, 45

Fermentation, classes, 173
Ferns, by collodion method, 111, 158
Finger, mechanical, 13
Food exhibition, Washington, 170
Foraminifera, collecting, 93
from chalk, 108, 172
Fossil, oldest microscopical, 150
Freshwater clays, origin of New Jersey, 118
Fruit skin, 173
Fungi of leaves, 155

Geological surveys, made useful, 28
Glycozone, therapeutical uses, 139

Gold crystals, 61
Guan , 51

Histology, literature, 154
Hydrogen dioxide, 157

Ice, dangerous, 46
Illinois, scientific work, 13
Illumination, Cunningham's criticized, 146, 153, 169
dark ground, 155
Immunity, definition, 171
Ink for glass, 27
Insects, mounting when small, 143
Iron wood, section of stem, 18
Ivy, section of stem, 114

Leaves, bleached, 152
Lichens, examining, 12, 94
Linen-prover, 107

Marine organisms, slides, 8, 27
Medical education, higher, 14
Meridium circulare, 45
Metals, crystals, 61
Microphotograph, simplified 30, 156, 183
Walmsley's enlargement, 10
Microscope, for beginners, 110, 175
biological, Swift & Son, 92
and dairy, 98
dissecting, 155, 188
lucernal, 107
and natural history, 91
for recreation, 142
selecting, hints, 107, 137
stage, 180
Microscopical apparatus, 143
Society, constitution, etc.:—
Belgium, 72
Lincoln, Nebraska, 89
Ottumwa, Iowa, 105
Soiree, Washington, 9, 54
Microscopist, a lady, 75
Microtome knives, care of, 4
Mosses, mounting, 78
Mounting with glycerin, 56
brass plate for, 131
balsam, to clean slides, 114
for polariscope, 183
fresh, 172
finishing, 56
ringing, 45
with starch, 182
with asphalt, 184

Newberry Fund, 15
Nosepiece, double, 154

Objects, fixed to a slide, 172
Objects under the microscope, 1, 17, 33, 49, 65, 81, 97, 113, 129, 145, 159.
Objectives, Immersion, 133
Ocular, catoptric, 10
Ophiocoma, discs, 1
Oysters carry typhoid, 179

Paraffin, 182
Paste-eels, 109
Petrifying method, 10
Photograph without a camera, 6
Platinum crystals, 61
Pollen, examining and mounting, 109
tubes, 61
Potassium permanganate and cyanide, 103
Practical suggestions, 11, 30, 45, 61, 76, 93, 109, 128, 143, 154, 172
Protococcus, mounting, 85
Publications, 31, 46, 63, 78, 95, 110, 158

Queen & Co., assignment, 170
Questions answered, 10, 29, 44, 60, 93, 107, 154, 171

Radiolaria, cleaning and mounting, 29
from Manitoba, 49
Rock, grinding slices, 108

Sand grains, what they teach, 159
Scalariform ducts, 3
Science Gossip, 13, 31, 46, 63, 157, 173
Sclerenchyma, examining, 12
Section, bayberry tallow method, 31
cutting, 11
of teeth, petrifying method, 10
Shanks, Dr. S. G., 10, 29, 44, 60, 93, 107, 154, 171
Shepherd's purse, 45
Silver, crystals, 61
Slides, mailing, 44
made with asphalt, 184
Smelt, examining, 65
Snails, tenacity of life, 28
Snow, red, 50
Snowthistle, section of stem, 113
Spermatozoa, how to detect, 44
Spiders' thread, diameter, 58
Sponges, 21
Spontaneous generation, 39
Spot lens, 93
Spottiswoode, Mrs., 75

Spruce, section of stem, 81
Stentor, where to find, 60
Stokes vs. Cunningham, 153
Stone, building, microscopy, 14
Sycamore, section of stem, 20
Synapta, mounting, 62

Tapeworm, sections, 144
Tempere on aquariums, 177
Textile fibres, literature, 10
Tin crystals, 61
Tourmalin, how to obtain, 104
Trichina, staining and mounting, 11
cyst, 130
Tube length, 108
Tyhoid fever, 120, 179

Uncinula necator, 76
Urinary analysis, literature, 154
Urine, spermatozoa, 44

Vegetable sections with crystals, in glycerin, 60
to prevent turning dark, 152

Walker Prize in natural history, 151
Water, micro-organisms, 106
Wenham's stand, 182
White's sections, 15, 113
Willson, L. W., 11, 30, 45, 61, 76, 93, 109, 128, 143, 154, 172
Writing, examined, 30

LIST OF ILLUSTRATIONS.

Disc of Ophiocoma 1
Scalariform Ducts 2
How to Sharpen Knives 5, 6
Section of Stem of Beach 17
" " " " Ironwood 19
" " " " Sycamore 20
Twenty Kinds of Bacteria that Produce Disease 33
Tyndall's Sterilizing Apparatus 41
New Forms of Radiolaria 49, 50
Red Snow 51
Anatomy of the Smelt 65
Section of Stem of Spruce 81
Some New Desmids 97
Vegetable Sections 113, 114
The Crab Louse 129
Cyst of Trichina 130
A New Dictyosphærium 145
Shufeldt's Photo-micrographic Outfit 156
The Composition of Grains of Sand 161
The Excelsior Microscope 175

New York Botanical Garden Library
3 5185 00289 5504